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LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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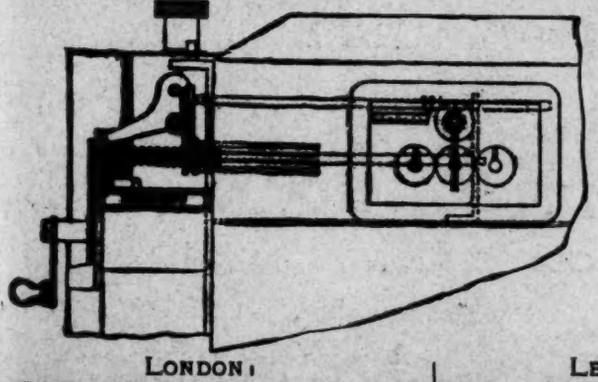

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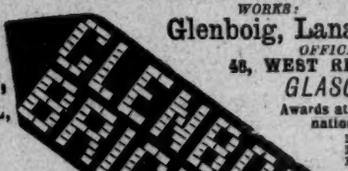

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EDITORIAL NOTES.

Steps to Financial Relief for Gas Undertakings.

How many men in the gas industry have ever stopped, in the rush and pressure of current circumstances, to inquire whether they know of any other industry that is so oppressively financially conditioned and handicapped in these times as the one to which they themselves belong. They would have difficulty in finding another. Take the chief industries working under special statutory powers. There are the railways under present control, with—be the costs of coal, labour, and materials, and the other conditions of working, what they may—a decent dividend guaranteed. There are the electricity supply undertakings, with in most cases a right to a minimum sum of 13s. 4d. a quarter for any consumption under twenty units, and a maximum of 8d. per unit may be charged. For lighting, with metallic filament lamps, the unit is only equal to 800 candle-hours, for heating 3420 B.Th.U., and for power 1¼ H.P.H. With incandescent gas-burners the 800 candle-hours can be obtained with a consumption of 32 c.ft., the 3420 B.Th.U. by the combustion of 7 c.ft., and the 1¼ H.P.H. by the use of (say) 20 c.ft., or rather more according to load. This indicates the great difference allowed by Parliament between gas and electric charges on the basis of equivalent service. Certain of the electric concerns have obtained permission from the Board of Trade, for the period of the war and for a time after, to exceed their prescribed maximum charges. Furthermore, electricity companies are not working under a sliding-scale; and no great change is seen in the war-time dividends of the normally paying concerns. There are the coal mines (which are not statutory concerns, though with general legislation specially applying to them), not in ordinary times regulated in any manner so far as charges and profits are concerned, now under control; and the scheme which the Coal Controller has been arranging in consultation with the various Coal Associations provides for (it is understood) the maintenance of the pre-war return upon the capital investment in the mines.

There are other statutorily controlled industries or undertakings; but there is not one so financially tightlaced as is the gas industry. There is confidence in challenging denial of this. The causes for this are of long past and comparatively recent origin. Some of those of recent origin disclose the highly essential character of the industry to the nation; but those in high places responsible to the nation for being just in their administration and control appear to be guided by the strange principle that the more indispensable is the industry, the less shall be the consideration meted out to it at the time when consideration is most needed. The gas industry is in one respect suffering from the fact that it is one of the pioneer industries to work under the control of Parliament. It has, in consequence, been largely the subject of experimental legislation; and step by step in every direction—capital issues, dividends, gas prices, reserves, and carry-forward—there has been regulation. In part, this refers more to private gas enterprise than to municipal gas undertakings. But the latter have certain regulations applied; and upon them as upon private undertakings there fall the war time burdens, as well as the revenue restrictions imposed by past legislation and accentuated by present conditions, together with the revenue limitations produced by departmental governing of the prices of certain commodities and export prohibition.

The cost of coal delivered on the works is terribly high; the cost of oil (if it can be obtained) is prohibitive for gas making, or supplies have to be used very sparingly; the export of coke can only be made under licence; sulphate of ammonia exports are prohibited; tar can only be sold after all that the Ministry of Munitions require has been removed from it; pitch is largely unsaleable on account of freights and shortage of tonnage; prices are limited for all the products of oil and tar washing and distillation needed by the Ministry of Munitions; and sulphate of ammonia for home use has been fixed at a price that has made the producers give vent to their dissatisfaction. Never, we repeat, has there been an industry controlled more closely and more exactingly when more latitude is so necessary; and no other industry can allege itself to be a greater victim of legislative regulation and war effects acting in combination and cumulatively. The raw material of the industry is coal; and the coal industry is allowed to charge 4s. per ton extra (the Welsh part 6s. 6d) in order to cover war expenses. The gas industry has to pay this additional charge per ton—running, without the extra paid to the Welsh and Forest of Dean collieries, to some £3,600,000 a year upon 1913-14 costs. It has to pay more for all the materials, the goods, and the labour it requires, including those that are essential to the making of the products needed by the Ministry of Munitions and the fertilizer necessary to the intensifying of the production of food. While the industry has to pay these higher wartime costs, with no allowance made for them, as in the case of the coal and sulphuric acid industries (so preserving their return upon capital), it has been decreed that it must be content with lean prices in present circumstances for the products required for munitions and for food production. The prices the farmer is to be paid for his cereals are controlled, but at figures that give a very good margin for his increased expenses; and it is the gas industry that has to supply him at a (having regard to costs from coal to acid, lime, wages, &c.) low price with the fertilizer that enables him to largely increase the produce from a given area of land, and the profits from that enlarged produce on the high-scale price allowed. From what has here been said, and from an examination of the position, it will be seen that the competitors of the gas industry for light, heat, power, and fertilizers other than sulphate of ammonia (true the supplies of other fertilizers are not great), are carrying on their business on much more favourable terms than the gas industry, which in the total has to contribute heavily to the national and local exchequers.

The case, therefore, seems to be complete, if only by contrast with the conditions obtaining in other industries, for some special consideration for the gas industry. What is now advanced generally regarding this matter is attested more particularly by the accounts of every gas undertaking in the United Kingdom. Some of them may have had during the period of the war a considerable augmentation of the business in gas through special demands for munition work. They are the favoured ones. But for them, too, the net profit per unit of production has been much below the pre-war level. Nearly two years and nine months have passed [see "JOURNAL," Nov. 3, 1914] since we first called attention to the then known and the possible effects of the war upon the financial conditions of the industry. But then ours was as the voice of one crying in the wilderness. The pre-war financial experiences in the industry—the ups and downs which it had safely encountered through the diversity of its business—gave its administrators to believe at the time that it could financially withstand almost any shock or weather any storm. There has since been disillusionment; and the lessons of the present particular form of adversity are of so practical a character as to make men not only think but act. Three years is a good

span; and we are within a few days of this being the time that there has been, owing to the war, a step-by-step ascent in the outgoings of the industry, and for sliding-scale companies a step-by-step descent in dividends owing to the necessity for again and again raising the price of gas, until now there are companies who cannot pay even their standard dividends, from which have to be deducted a heavy income-tax. Maximum priced gas companies, too, have been eating into their reserves in the hope of better times; and some of them are looking forward with any but pleasant feelings to the outcome of this year's working. Not a few local authority concerns have likewise been severely hit. The time has come when there should be no further delay in this matter; but the Board of Trade should be appealed to very insistently to move on behalf of the industry to relieve it from further financial depreciation by getting Parliament to sanction a scheme by which a fair return may be received on its capital, leaving the larger question of the revision of the sliding-scale to a more convenient time, when the industry and our legislators are better able to measure the differences between *post*-war conditions and those existing 42 years ago, when the terms of the sliding-scale were determined—surely not for all time and for all conditions. Whatever the old intention, the view has grown in the industry that we have now come to a pass when this matter must receive attention. The articles and correspondence in the "JOURNAL," the references in speeches, the comment on the matter by Mr. A. E. Broadberry in his recent Presidential Address to the Institution of Gas Engineers, the allusions to the subject in the reports of the National Gas Council, the interviews and meetings on the question, all point to the extension of the feeling that the sliding-scale, with its unqualified terms, does not meet the need of all times and conditions.

There are other people who think the present conditions will soon roll by, and easier ones prevail. Who has any substantial ground for thinking so? Lord Kitchener said the war might last one year or three years. Do we yet look like being near the end and clearing up the terrible chaos? How long is it to be before we reach a *post*-war normality? One, two, three, or how many more years? Even then capital, materials, and labour are going to be dear. Who thought even two years ago the present conditions would prevail? Let the industry speculate no more on chances. But let it press for a scheme of relief, with which, under the authority of Parliament, it can meet the public, and charge a price fitting the circumstances and giving stockholders a fair return on their capital. Harder conditions and the growth of view that further effort should be made has led to the National Gas Council to take another step. This was decided on at a special meeting to consider the sliding-scale question after the general meeting of the Council on the 4th ult. It was then arranged that information should be collected, on behalf of the Council, from all gas undertakings, in the Commercial Section areas of the District Associations, and that each of the sections should nominate two representatives to join the Executive of the National Council to consider the information collected, with a view to arriving at a decision as to what steps (if any) should be taken to obtain relief. The inquiry that is being made covers all classes of undertakings; and the undertakings are asked to submit suggestions as to the steps they think it would be advisable to take for obtaining relief. It is very necessary that the Council should have the maximum of useful information and suggestion, so that they may go to the Board of Trade with the strongest possible case. The problem is a very serious one for the Executive Committee to handle; and it should receive their most earnest consideration before coming to any decision. Remember that the financial position in which the industry has arrived through legislation, war conditions, and price restrictions, is one from which there will not be immediate recovery on the termination of the war, which happy event may not occur before conditions are still worse for the industry. On these grounds, the industry should act as a whole; and let the managements of those undertakings that are exceptionally fortunate help and not hinder those less fortunate.

Gas Composition and the Board of Fuel Research.

THE question of the composition of town gas is now in a fair way of receiving thorough investigation; and for the reputation and future of the industry we are not sorry. The Board of Trade has no doubt been moved to action by the pressure brought to bear by local authorities and the railway companies who have accumulated evidence—and some of it is very damaging evidence—that there are gas undertakings that have been distributing gas containing percentages of incombustibles largely in excess of what was justified even by the abnormal circumstances of current working. Now that the matter is coming to a head as a preliminary to parliamentary action, there is satisfaction in the fact that the investigation has been entrusted to so competent and (we believe) impartial a tribunal as the Board of Fuel Research, the members of which are fully alive to the needs of the times, as well as to the evil effects of any abuse of privileges in respect of avoidable gas adulteration. For this particular work, the Chairman of the Board (Sir George Beilby, F.R.S.) has high qualifications; and not long since at the Royal Society of Arts—this was at the time that Mr. H. M. Thornton read his last paper—he referred to the requirement in our national equipment of a greater production of cheap and, if necessary, of poorer fuel gas. The Hon. Sir Charles Parsons is aware—no one more so—of the need of the industries for cheap and smokeless means of generating steam and other forms of power, as well as of heating. What is true of the industries in regard to heating is equally true of the home. Mr. Richard Threlfall, F.R.S., as an electro-chemical engineer, knows the same. Sir R. Redmayne, K.C.B., his Majesty's Chief Inspector of Mines, is cognizant of the need for the economical use of coal by the fullest utilization of its constituents; and Prof. W. A. Bone, F.R.S., knows all the phases of the subject from beginning to end.

The investigation is one that cannot be hurried; and while the conclusions will unquestionably be far-reaching, the Board of Trade, and those who have been agitating for an investigation, will find that the problem is not so simple that any single determinate prescription for town gas will be forthcoming that can be applied to the whole gas supply of the country, unless it be one that possesses a very large margin which will give ample scope for all coals and for all methods of carbonization and conditions (including progressive depreciation) of plant, and which will, through its indiscriminate spaciousness, give greater liberty in some cases than in others. The reference by the Board of Trade to the Board of Fuel Research is to all intents and purposes divided into three distinct parts; the last one being subdivided. These parts are: (1) To advise as to the most suitable quality of gas; (2) the minimum pressure at which it should be generally supplied; and (3)—this bears upon the first part—the Board are to have regard to (*a*) the question of economy in the use of coal, (*b*) the adequate recovery of bye-products, and (*c*) the purposes for which gas is now used. It is a good thing that the Research Board has upon it men who are specialists in the utilization and chemistry of fuels, as there is room in this large reference for incompetency to go vastly astray.

Take the first and third parts together. Any advice given to the Board of Trade as to the most suitable quality of gas must take into consideration the question of the coals carbonized; for a large amount of economy is concentrated in employing the most available suitable coal, which can be delivered on the works at the lowest possible price. Our parliamentary authorities in the past—this is not their fault, it is the fault of those human limitations which prevent any man being a specialist in all things—have apparently thought that it is the easiest possible thing in the world to make gas economically to fit a universal single standard of quality. The probability is that the investigation by the Board of Fuel Research will disabuse their minds of this. It will in all likelihood be shown that it is not necessarily the calorific value of a gas as instrumentally measured that constitutes the most suitable quality for town purposes, but the gas, having regard to the cost of production, containing the largest percentage of combustibles, the flame temperature of which gas on its combustion is not depreciated by avoidable inert constituents, a fair limitation of which can only be determined by an analysis of the gas produced by different coals treated under different conditions of normal carbonization. But regard has to be paid to the question of the economy in the use of coal. Economy in its use by whom? The reference in this respect is a very open one. If the Board of Fuel Research broadly construe it, it leaves them to consider it from the aspect of economy in the use of coal both by the gas supplier and by other people who could employ either coke or a good combustible gas as fuel. The two directions of economy have a beneficial reciprocal tendency. The possibilities of the dilution of coal gas with a high combustible percentage gas made from coke is one

direction in which to look for coal economy. If there is economy there in cost, it may be the means of producing economy by supplanting the industrial and household use of coal by the resulting mixed gas—a gas of high heating quality—at a lower price than would otherwise be possible. There is in relation to "*c*" several purposes for which gas is utilized in which flame temperature is a factor of considerable importance; and it may also be said that there is scarcely a purpose for which bituminous coal is used for which a cheaper gas or coke could not be employed with greater advantage to user and the nation—including for the user labour-saving and enhanced efficiency, and for the nation the prevention of atmospheric pollution with all its attendant uneconomies, and the preservation of the valuable constituents of coal that are destroyed when it is ruthlessly used for the single purpose of heating. The supersession by gas or coke of the coal so burned would ensure an adequate recovery of bye-products, which is a matter in which the Reconstruction Committee of the Government should be concerned.

There is the question of the minimum pressure at which gas should be supplied. This is a difficulty. We have no sympathy with the old minimum pressures. They are out of gear with the times; and they are rarely to be found now where there is a well-planned distribution system, or one which has been kept up to date by the application of auxiliary means of supplementing and maintaining pressure. But there should be no increase of pressure beyond local current practice (which rarely has anything to do with the present prescribed minima) without post-war time is allowed for adjustment to the new condition. To raise the minimum pressure above current practice would, in a large number of cases, mean a considerable reconstruction of the canalization system or the installation of means of boosting. Reconstruction work can only be done piecemeal; and this takes time. During the war such work and pressure-raising plant installation have perforce had to be postponed, unless absolutely imperative for munitions work.

The National Gas Council will probably now find good use for the Special Committee they appointed in relation to the movements in fuel economy, power provision, and reconstruction; and the Institution of Gas Engineers and the Leeds University, for their Gas Components Committee. It is a pity the work of the latter is not further advanced, so that the results could be laid before the Board of Fuel Research. However, this reference by the Board of Trade gives the gas industry a fine opportunity for proving its fitness and willingness for taking a large part, through its varied service, in the national development to which all are looking forward.

Hackney Undue Preference Case.

THE case in which the Gas Light and Coke Company allege that the Hackney Borough Council show an "undue "preference" to electric power users in the supply of energy for lighting purposes—that is to say, to those who are permitted to use for lighting 20 p.ct. of the energy taken under the power tariff of 20s. per KW. per quarter of maximum power demand and ½d. per unit in addition—has been argued before Mr. Justice Astbury; and his Lordship's decision is now being awaited. Whatever the decision may be, there can be little question as to the case going forward to the Court of Appeal. From the Gas Company's point of view, the contractual condition as to lighting is nothing but a bait for custom, a disadvantage to competitors for the same custom, it constitutes a distinction, and confers, it is held, an undue preference, as against the manufacturer who needs a supply for lighting only and in favour of the manufacturer who requires a "corresponding supply" for lighting, *plus* a supply for power. It gives, too, an advantage in respect of lighting, so it is submitted, to those manufacturers whose power requirements are large, compared with those whose power requirements are small but whose lighting requirements are equally large, and whose excess of requirement for lighting beyond (over the 20 p.ct.) has to be paid for at a heavier rate. From the Hackney point of view, there is no undue preference in respect of lighting, because the power "circumstances" are not "similar." A great deal, of course, depends on whether "corresponding "supply" is intended to mean "corresponding" purpose, and, taken in conjunction with the words "similar circum-"stances," the Long Eaton case appears to warrant a very definite conclusion.

However, during the evidence, the load factor and the diversity factor were put up, and made much of, to show that the working of an electric generating station is vastly influenced by them. From the arguments the fact emerges with well-defined clearness that the incidence of the 20 p.ct. of cheap units must be on the peak of the ordinary lighting load, when all other lighting consumers would be paying more for their current than those fortunate manufacturers with the 20 p.ct. allowance. These men do not use the 20 p.ct. for lighting during the daytime, but at the same time that other consumers are using their units for a corresponding purpose. Much of the argument on the technical points would have had better place in the Parliamentary Committee Rooms than in the Law Courts. The latter have no concern with effects on generating stations; their concern in this particular matter is to see whether what is being done is an infringement of the existing law, or "undue "preference"—whether it confers something of a favourable nature upon one consumer over another for a "correspond-"ing supply." If so, then it is illegal. His Lordship incidentally asked, "Why cannot the undertaking give a better "rate to a man who takes a larger quantity of current than "to one who takes a smaller quantity?" We cannot see why not, provided that it is for a "corresponding" purpose. But does a power supply correspond to a lighting supply? If it did, it would be supplied at equal rates. But the rates widely diverge. The whole of the arguments in regard to load and diversity factors go to prove that the two supplies do not correspond; and therefore the inclusion of lighting units in power supply at power rates is a vitiating element. However, we are expecting to hear early this week what his Lordship thinks of the matter; and then probably, as remarked, steps will be taken by the side defeated in the first bout to carry the matter further.

The Chemist and the Gas Industry.

THE members of the Society of Chemical Industry, at their annual meeting last week under the Presidency of Mr. Charles Carpenter, D.Sc., must have drawn the conclusions from the general proceedings that the gas industry is at present much alive, and that it presents a vast and fertile territory for scientific and chemical workers. Indeed, some members of the Society whose working orbits are of a very restricted character must have been highly envious as they heard Mr. E. W. Smith treating of many aspects of the subject of the production of industrial gas, Mr. T. F. E. Rhead dealing with sources of benzene and toluene in which he showed that gas-works are one of the prolific sources, Mr. W. J. Pickering surveying the work done in relation to the calorific value of industrial gas, and Mr. C. M. Walter telling of the big scope there is for scientific and commercial work in connection with the developments of the industrial application of gas for heating purposes, in which paper was predicted the day when solid-fuel furnaces may, through the economic virtues of gas, become things of historic interest, though not of veneration, except as steps in the progress of industrial civilization. All these workers hailed from the stations of a single Gas Department—that of Birmingham. The papers were illustrative not only of the expanse that the gas industry offers the scientific worker, but of the stores of commercial development that are opening up to it, and the possibility of still more lying concealed until unearthed. This being so, is it to be wondered at that one who has lived in, and grown with, the gas industry as has the President should be impressed with the need for a revision of our educational system, in order that, at any rate, elementary chemistry may be taught as a matter of course, so that the seed that fall on good ground may fructify, and produce more chemists whose talents lie in the direction of research, and impart to men generally a sufficiency of knowledge of the subject to enable them to appreciate the value of the co-operation of science with practice?

To the want of the power of such appreciation through the neglect of early inculcation is attributable an enormous waste, an enormous loss of time, and the world has been jogging along far behind the advantages it might have enjoyed before if only it had worked as it should have done. What Mr. Carpenter urges is that opportunities for assisting to promote individual and collective betterment should be given to every brain, but by improved ways. The gas industry can endorse the suggestion and the reasoning; and what is true in respect of the gas industry is true of other industries. It is a strong indictment of a very grave neglect,

from which the gas industry cannot stand apart, when the President can speak of the unscientific development of the country's fuel resources, and when Mr. Smith can say, "There is a strong case for the Government or some com-"petent authority to set up a scientific and practical Com-"mittee, versed in the conditions of carbonization, to go "into the whole subject (even if at considerable cost) in an "independent manner, in order to settle it as far as is prac-"ticable at the present time." This was written before the reference by the Board of Trade to the Board of Fuel Research was promulgated. The reference, however, tells a tale of a prevailing indecision, which only scientific research can put right. The paper read by Mr. H. W. Rowell on co-operative research, in which he urged investigation by, among others, tar distillers, and that by Messrs. Walter C. Hancock and W. E. King on refractory materials both accentuate the work there is to be done in connection with coal carbonization and the resulting products which has not yet been done, but much of which might have been if there had not been such an ignorant evasion of opportunities. The same remark applies to the Gas Components Committee of the Institution of Gas Engineers, about the lines of whose work Mr. Smith gave some information. However, it is something to get such a large recognition of requirements; and, in the position to-day, there is much over which to be hopeful and confident.

Coalite Rumours and Speculation.

A time ago the British Coalite Company took unkindly to certain comments of ours about the repeated promises made as to the fulfilment of the technical and commercial success of their system—whatever the character of its organism and the method of its operation. If ever success is achieved, it will be through a long drawn-out comedy of errors, which prove an absolute inappreciation of essentials from the initial stages. Hope, real or otherwise, now rests on the results of the Barnsley Smokeless Fuel Company's plant—an offshoot of the British Coalite Company. In the letter published on Nov. 14 last, when the British Coalite Company sought by a singular effusion to reprimand us for our views, the promise was made that, in a few weeks or a few months, the plant at Barnsley would be at work; and then the revelations would make us regret our criticisms. There has been patient waiting; the disclosures of that plant are not yet forthcoming. But there has lately been some speculative buying of Coalite shares, on the strength of rumour that something or other valuable is going to divulge itself. That has been the intermittent rumour since (the late) Thomas Parker was granted his original patent eleven years ago. But every rumour has had its day; and the share speculators have found themselves poorer for their deal, and those with shares to part with better off than they were before. The best advice the public could accept is to refrain from speculation in Coalite promises until the results of the new plant have undergone independent and competent investigation, together with the commercial position.

Receding Low-Temperature Carbonization.

It is pretty clear that the system, if it can be so called, has been almost completely metamorphosed, and that it now possesses little of its original character, as covered by the specifications of Mr. Parker. It is now a design of slowly evolved ideas; and we think it will be found to have passed from what can be truly called low-temperature carbonization to something that is a greater distance on the road to the high-temperature process as practised in gas-works. If so, then the primary product will not be Coalite with a good percentage of volatile matter in it. There have been two recent publications in our columns which show that the fascination of real low-temperature carbonization is now fading away, through the disappointing results in the products themselves. Among those who have been making investigation into low-temperature carbonization is Mr. Robert Maclaurin, who has himself devised a system of working; and in his paper read before the Society of Chemical Industry [of which notice was made on July 10, p. 68] he gave results from his researches. These results have produced conviction in Mr. Maclaurin's mind that it is hopeless to look upon the low-temperature method for the purposes of making town gas; and that there will have to be a departure to a semi-high temperature method, which means a lessened amount of volatile matter in the coke, upon which the Coalite people have been relying as a distinctive feature and a recommendation over and above the gas-works variety. Then we have "Nemo" writing in last week's issue, and pointing out that the Barnsley Company's prospectus claims that their smokeless fuel will contain a "considerable percentage" of volatile matter, and "large volumes" of motor spirit, benzol, toluol, zylol, and carbolic and cresyllic acid or oils. "Nemo" pricks the very pretty bubble. One cannot have all these things from a true low-temperature process. He states the reasons. The scientific man conversant with the production of low-temperature oils or tars knows them; the public does not. "Considerable percentages" and "large volumes" may attract the lay man of a speculative turn of mind. It has attracted him before in connection with "Coalite;" but truth requires a modification of claims, and an admission that the path of actual low-temperature carbonization has been left for one that brings the "Coalite" system much nearer the temperatures now practised by gas-works. The self-appointed, dogmatic critics of, and prescribers of new carbonizing practices for, the gas industry, before they will again allow their sprightly tongues to wag, may perhaps consider the trend of knowledge and reform of carbonizing systems distinguished by the description "low temperature."

Gas Heating and Next Winter.

This ought to be a big gas-fire and gas-cooker fixing season for those who have the fires, the cookers, and the fitters. While the military authorities are, with heavy hand, whittling-down the fitting power of gas undertakings, the Coal Controller urges the public to use gas fires and cookers in order to save as much as possible coal distribution next winter (gas-works being expected to stock themselves well with coal against the winter's eventualities); the Ministry of Munitions urge the same course of procedure, in order to give more gas from which to extract the properties for the making of explosives and sulphate of ammonia; and in the food and home labour-saving campaigns, there is advocacy to the same effect. In short, there is a perfect deluge of recommendation all favourable to the gas-heating business; and the gas industry will do its level-best, in the retarding circumstances of the time, to make effective to the public the counsel of the various authorities. The difficulty of obtaining coal supplies last winter, together with its severity, has at any rate in some gas-supply areas made the public very desirous of having additional strings to their heating bow. From London districts and different parts of the country comes intelligence of local authorities with large institutions under their control ordering considerable numbers of gas-fires. This is all very well where there is a margin of coal-gas and water-gas manufacturing plant to take the flights of peak loads when the indications of the thermometer are travelling towards zero. There will be good use made from now onwards of the coal-economizing assistance of blue water-gas. Last winter saw many gas-works hard pressed, through their inability to obtain during the war sufficient material, labour, and plant for extensions, repair, or replacement. But nothing that can be done now should be left undone to satisfy the public, as this is all to the good for "after the war." Electric light users are found in places to be most anxious to have gas-cookers and gas-fires. This is a good field for the hire-purchase system. Personal possession means permanent custom.

Figures from Manchester.

The usual summary of the report of the Manchester Corporation Gas Committee on the operations of the past financial year, which appears in the news columns of this issue, shows that the gross profit is some £40,000 less than was the case a year ago, while, owing to the fact that £6000 odd more has had to be paid for interest on loans, &c., the net profit is down from £141,234 to £93,780. As before, the city fund receives £50,000 in aid of the rates; but whereas the deficit which was brought into the accounts amounted to £34,009, there is on this occasion an excess appropriation (including sinking fund contribution for redemption of loan debt) of £53,951 to be carried forward to next year's account. Turning to the works statistics, it is seen that the quantity of gas sold was something under 2½ p.ct. less than in the previous year. The estimated decrease arising from the operation of the Summer Time Act was equal to 1·8 p.ct. on the annual consumption; while the falling off in the quantity of gas supplied for the public lamps is calculated at just over 1¼ p.ct. on the

output. Not the least interesting feature of the Manchester gas accounts is the collection of statistics made by the Superintendent (Mr. Fredk. A. Price) by which they are always accompanied. The information furnished is of a very complete nature; though this year Mr. Price has succeeded in finding a new table which he could introduce. This gives for the past twenty years—the period covered by the tables generally—the quantities of gas transmitted from the works divided up into day and night consumption. It shows at a glance the progressive nature of the change that has been taking place over that time in the character of the demand. Whereas in 1898 the day consumption was 26·56 p.ct. of the total quantity of gas transmitted from the works, for the year ended March last the figure was 45·31 p.ct.

And Other Places.

The report on the working in the past year of the Birkenhead Corporation gas undertaking indicates that a very substantial decrease in the consumption during the first three quarters of the year was nearly made good by the gain in output experienced during the final three months. Points to which the Engineer is able to draw special attention are the make of gas per ton and the coke sold per ton of coal—both of which constitute a record for the works. Over 12,000 tons more coal was used, because for five months the carburetted water-gas plant was left altogether out of operation, so as to economize oil and coke. It is stated in the report that, in the matter of cooking-stoves, Birkenhead is approaching saturation-point in proportion to the number of consumers, and that it is from fires and hot-water apparatus that future increases must come. The results of an examination (by a correspondent) of the accounts and statistics of the Dundee gas undertaking are set out so as to reveal the gratifying progress that has been made over a period of years. Stourbridge has to report a decrease in the sale of gas, through both ordinary and prepayment meters, as well as for public lighting. So far, at any rate, as private consumers are concerned, the falling off is attributed largely to the operation of the Summer Time Act.

A Union of Manufacturers

For the purpose of undertaking kinds of work the need for which is daily becoming more widely acknowledged, there has been registered as a company limited by guarantee, and not formed for the purposes of profit, the Incorporated National Union of Manufacturers. The number of members is unlimited; and the management is vested in an Executive Council, a published list of the first members of which includes, among a wide range of industries, Mr. F. M'Leod, the Secretary of the South Metropolitan Gas Company, and Mr. D. D. Macpherson, of the Gandy Belt Manufacturing Company. For the guidance of any other "JOURNAL" readers who may consider the advisability of joining this new Union, it may be stated that the objects set forth are to undertake any of the liabilities and assets of the British Manufacturers' Association, 1915; to promote the home, colonial, and foreign trades and industries of the United Kingdom; to encourage free intercourse between masters and workmen; to render pecuniary, legal, and other assistance to small essential industries (other than members of the Association) in case of need; and to collect and disseminate statistical and other information. In all the directions named there must be ample scope for the exercise of useful effort; and the larger the membership roll of the Union, the greater will be the power behind these efforts.

The Gas Light and Coke Company's Dividend.

The Secretary of the Gas Light and Coke Company (Mr. W. Beckford Long) announces that, subject to audit, the Directors of the Company have declared a dividend on the ordinary stock for the past half year at the statutory rate of £3 14s. 8d. p.ct. per annum. [Under their Act which, as intimated in last week's issue, has just received the Royal Assent, the Company are empowered to hold annual, instead of half-yearly, meetings of the proprietors; and advantage will be taken of this provision to meet only in the early part of each year.]

Calorific Standard Orders.—The Local Government Board have made Orders under the Gas (Standard of Calorific Power) Act, 1916, for the City of Birmingham, the Shipley Urban District Council, and the Borough of Southport. In each case the standard calorific power is 500 B.Th.U. gross.

COAL GAS (NOT WATER GAS) TO BE MADE.

Referring to the appeal recently issued to the gas industry by the Controller of Coal Mines, urging the substitution of water-gas for coal-gas to the greatest practical extent, with a view to effecting coal economy, it was last night officially announced that certain factors have since arisen which require a reversal of this policy; and with a view to securing the maximum quantity of coal-tar products, the Minister of Munitions urges that all carbonizing plants at gas-works be worked to the fullest extent, before any water-gas at all, carburetted or uncarburetted, is manufactured. The Controller of Coal Mines, who is aware of the altered circumstances, will co-operate with the Ministry of Munitions in this matter, and will give instructions for all necessary coal to be delivered to gas-works for carbonizing purposes.

QUALITY AND PRESSURE OF GAS SUPPLY.

Board of Trade Action.

ON Thursday last the Board of Trade issued to the Press the following announcement:

Various questions of a technical character having recently arisen relating to the supply of gas, the Fuel Research Board have undertaken, at the request of the Board of Trade and other Government Departments concerned, to conduct an investigation and to advise them as to the most suitable composition and quality of gas and the minimum pressure at which it should be generally supplied—having regard to the desirability of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used.

PERSONAL.

A note in the "Croydon Co-Partner" states that Captain W. H. TOPLEY, the Editor, has been wounded. Happily, however, he himself describes the injury as not serious.

The Council of the Royal Society of Arts, at their first meeting for the new session, elected as their Chairman for the ensuing year Mr. ALAN A. CAMPBELL SWINTON, F.R.S., in succession to Mr. Dugald Clerk, D.Sc.

At a meeting last Wednesday of the Council of the Leeds University, Mr. JAMES W. WOOD, M.Sc., was appointed Research Chemist in the Fuel Industries Department, to work under the direction of a Joint Committee of the University and the Institution of Gas Engineers.

Mr. GEORGE KEILLOR, Assistant Gas Manager at Dundee, has been appointed Engineer and Manager at Greenock. He is 43 years of age, and prior to the amalgamation of Broughty Ferry with Dundee was Gas Manager at the former place. On completing his education, he entered the service of the Nairn Gas Company, under his father, who was Engineer and Manager, and after three years' training was appointed Assistant Gas Manager at Hamilton, where he remained for five years. In 1899, he was chosen to be General Manager, Collector, and Inspector of Light to the Corporation of Peterhead, and in 1903 was appointed to Broughty Ferry.

CITY AND GUILDS EXAMINATION PASSES.

More Successful Candidates.

[See also *ante*, pp. 15, 59, 101.]

Gas Engineering.

FINAL GRADE—SECOND CLASS.

Niels Skovgaard, of Manchester.

GRADE I.—FIRST CLASS.

G. W. Morris, of Wakefield.

GRADE I.—SECOND CLASS.

A. Dyer, of Wombwell.
C. Wadsworth, of Wombwell.

Gas Supply.

FINAL GRADE—FIRST CLASS.

Niels Skovgaard, of Manchester.

The members of the Yorkshire Junior Gas Association have been invited to visit next Saturday the new works of the Longwood and Slaithwaite Gas Company, which will afford them an opportunity of inspecting the continuous vertical retort installation in operation there (on the "Dempster-Toogood" system), also the coal and coke handling plant, the gas compressors, &c.

ELECTRICITY SUPPLY MEMORANDA.

THE question of tariffs for electrical energy has been revived by the "Electrical Review." It has had a long rest from discussion, except in council chambers and committee and board rooms, where tariffs have been moved up, revised, and some of them shorn of their peculiar embroidery, and so simplified. Whenever the subject is reopened in the electrical papers, attention is arrested, in order to see what (if any) new proposal has been conceived; for there has never been a commodity, while being credited with so much intrinsic merit by its purveyors, that has had so many and such widely diversified methods of charging applied to it with the view to induce the public to purchase, nor the prices for which are, according to use, so far removed the one from the other. The amount of inventive faculty that has been brought to bear has been as great a marvel as the character of some of the tariffs, and the infinitesimal results in actual business in certain lines have been no less so. Time was when in the construction of tariffs there was some semblance to a scientific basis. But one by one the electrical purveyors, in their construction and adoption of tariffs, have dropped from the boasted high road of scientific rectitude down to a low level of crudity, which they can only justify by the old and convenient excuse of commercial expediency. This is a further proof of the difficulties of their advance in certain lines of business without recourse to something that is innocent of all those factors that should be taken into account in fixing the price of a commodity. Cost of production, capital and establishment charges, and all else are juggled with just as requirement needs. The attempt is to make the prices fit—and it is generally a misfit—the business sought, and not an endeavour to gain the business upon sound and defendable charges. Never has an industry been so unfaithful to business and scientific principles as has been the electricity industry in this matter of tariffs.

From the Path of Virtuous Tariffs.

There is the rateable value system, under which a lump sum is charged on the rateable value of a house, and so much per unit beyond—½d., ¾d., and perhaps in some cases to-day 1d. No one tries to defend this system from the equity point of view. If one dared, there are many glaring examples of its inequity. The very basis of the lump charge has no connection with cost of production, and capital, distribution, and other outgoings. A man under it may not use a pennyworth of current in the day time. His maximum demand may come on the peak load in the lighting hours, and yet the total of his consumption may not be any more than that of a consumer whose demand is spread over the day time as well as the earlier hours of darkness. The rateable value of a house that has "seen better days" may be low; the rateable value of the modern house (no larger in size) in the next street may be considerably more. The total consumption of the two houses may be the same. The former house gets its supply on the average cheaper than the latter, and thus enjoys preferential terms. One man on the rateable value system whose consumption is for lighting only may, through the operation of the system, get his lighting units much cheaper than another man. He likewise is favoured with the equivalent of a preferential charge. The allegation as to a defective foundation could, if necessary, be emphasized by the calling to witness of no end of such illustrations. Papers, too, have been read which show a considerable enlargement of consumption with total revenue that has not reached anything like that which previously obtained for a smaller business on a flat-rate.

Effects of a Wrong Basis.

The American electricity suppliers are discussing the simplification of their tariffs. And there is room for it. The "Electrical Review" thinks so; and it takes the occasion to admit that the rateable value system adopted by the British electric supply industry may not be "scientifically correct;" but it defends it thus—

An "Abstract Assessment" and a "Complex Average."

> When we consider that the cost of a KW.-hour supplied to a particular consumer depends on the distance and method of delivery, the time at which, and during which it is delivered—*i.e.*, the effect on the generating plant of the incidence of its delivery as regards the supply of energy to other consumers—as well as on the degree of efficiency of the generating plant, and sundry other lesser technical and operating considerations which, though pregnant with significance to the engineer, are as Greek to the consumer, and that the tariff has to perform the dual function of embodying the complex desires of the former in the simplest possible form which will appeal to the non-technical imagination of the latter, it will be obvious that it must in every case, irrespective of its simplicity or complexity, be an abstract assessment of value of service, based on a complex average.

This long-winded explanation is in its tail-end about as clear as ditch water. "An abstract assessment of value of service based on a complex average!" This in these days when we are all talking of the alliance of science and business! And this the best that can be said in defence of the rateable value system! Is a system of payment for electricity (the cost of which can, if desired, be definitely computed) that is founded upon such an extraneous factor as the rateable value of premises, truly described as an "abstract assessment of value of service based upon a complex average"? If nothing better than that can be said for it when every examination discloses the defects which subscribe to inequity as between house and house, consumer and consumer, use and use, then our electrical friends had better give up the task of trying to justify it, other than on the ground that they have to utilize a vitiated system, or resign all hope of getting business for domestic purposes other than lighting in view of the value offered by competitors, with simply constructed and relatively inexpensive appliances. This is the truth of the matter, which the "Review" secretes under that blanket of words, "abstract assessment of value of service based upon a complex average." We like this blanket, because of the confession we find reposing in it. When, too, an electrical consumer asks the electrical canvasser, or the gas man, "What is the rateable value system?" and he hears that it is an "abstract assessment of value based upon a complex average," he will no doubt be a happier man for the information.

Purchasing Co-operation of Residents.

The "Review" later in the article speculates, and makes a suggestion. "The prospect of developing the heating and cooking load looms so very largely in the future, that one is tempted to speculate as to the ways and means of hastening it." It suggests co-operation of the residents in a street. "If 75 p.ct. of the householders in a street containing (say) 100 houses were to combine and co-operatively purchase energy in bulk for resale at cost price to themselves from the supply authority, at the same time guaranteeing a certain average wattage of heating and cooking apparatus installed, this group of consumers would progress electrically at a much greater rate than the average consumer throughout the area." Why 75 p.ct.? The remaining 25 per cent., we take it, is to cover undesirables and empties. Did anyone ever hear of such a queer business proposition? Who of the 75 p.ct. would make himself responsible for the payment by his neighbours? We question, too, whether such a scheme could claim any legal authority. To whom would the distributing cables and appliances belong? Who would be the distributors in the eyes of the law? Who would be responsible for taking action to recover payment? "Any improvement brought about by this progressive group of consumers would be reflected in a reduction of charges to them, thus tending to still further development." To justify the preferential treatment, the supply undertaking would have to regard the whole of these co-operators as one consumer, and deal only with one. What under the existing law would be the position of the supply undertaking if a man in the street, declining to be one of the co-operating 75, went to the legal supply authority and said: "I want my current for lighting, for cooking, and for heating at the same prices as my next-door neighbour, who is one of the 75. My consumption for those purposes will be equal in amount to his?" The "Review" is really charmed with the cleverness of its own invention. Its advocacy unblushingly acknowledges that it is based on the doctrine of preferential treatment as a reward. It says: "In effect such a scheme would sort-out the good consumers from the bad and indifferent, *rewarding them as a class according to their merits*, and intensify and hasten on the domestic use of electricity and electrical appliances among those sections of the community most suited for the purpose. . . . Whereas it is impracticable to apply intensive development on a scale suited to a whole city, it is reasonable to assume that such development is possible *in the case of a selected section of the community*." The electrical industry has given birth to numerous schemes that have had a brief undeveloped life, and secret burial. Probably here we have another which will shortly require similar accommodation.

The Unhappy Board of Trade Move.

According to a resolution passed by the Bristol Corporation Electricity Committee, the Board of Trade's recent appointment of additional members of the Electric Power Supply Committee to represent municipal interests altogether ignored the Incorporated Municipal Electrical Association; in fact, that organization was not even invited to nominate a member. Perhaps the Board of Trade do not hold the Association in very high esteem. The Bristol Committee suggest that the Board be again requested to appoint one or two members recommended by the Association, "so that the technical side of the municipal case can be adequately represented." Mr. H. Faraday Proctor, the Electrical Engineer at Bristol, is Hon. Secretary of the Association; and this probably accounts for Bristol meddling in the matter. If protest had to be made, it should properly have come from the Association as a body. We do not know the date when the resolution was passed; but anyway the technical men on the Board of Trade Committee will not regard it as a compliment that they cannot adequately represent the technical side of the municipal case. Does this apply to Mr. Harold Dickinson, the Electrical Engineer of Liverpool? However, the Bristol Committee have the interests of the Association so much at heart that they decided to send their Chairman, one other member, and their Engineer to interview members of Parliament on the subject. We suppose this has been done; and that this is partly responsible for the recent heckling of the Board of Trade in Parliament. If not, then there may be still more in store for that much tormented department. At the same time, the Electricity Committee of the Hammersmith Borough Council are circularizing other electricity

committees, urging them to combine for the purpose of "demanding" (this sounds a bit impertinent when dealing with a Government Department) that the Board of Trade Committee should be dissolved, and that a small number of "competent unbiased persons not directly interested in electrical matters should be constituted in lieu thereof." The members of the Board of Trade Committee must possess a good dermal covering, or they would have shaken the dust of Whitehall off their feet long since, and have refused to return.

Further Proposals for Legislative Reforms.

The Association of Municipal Corporations is not often heard of in connection with electrical affairs; but the members of the Council have awakened to a series of legislative matters upon which they think there should be reform. The appointment of the Board of Trade Committee on Electricity Supply has stimulated ideas. The section of the Act of 1888 giving to a local authority a provisional veto is not, in the opinion of the Council, suitable to current conditions; and a reasonable modification of the terms of the section should be assented to. The provision giving local authorities the power of purchase also calls for consideration, as affecting the position of local authorities supplying energy outside their municipal boundaries. Where this has been authorized, the purchase by an outside local authority of the part of the undertaking in its area, would, it is submitted, undo the work done in the way of reducing the cost of supply through increased and diverse demand, and consumers throughout the whole area would suffer in consequence. It is suggested, therefore, that it should be no longer obligatory to apply to undertakings authorized by Provisional Orders the provisions of the Electric Lighting Act, 1888, as to purchase. Where, however, rights of purchase already exist, there should not be interference, except upon agreed terms. Relating to the promotion of Provisional Orders, notices to local authorities of intended applications, unless waived, are liable to cause the loss of a year in obtaining statutory powers, and constitute, therefore, a hindrance to the extended supply of electricity. The Council recommend that the provisions should be repealed. Another step to be taken to ensure a cheaper supply of electricity would be to encourage and facilitate the linking-up of two or more generating stations in neighbouring areas. Suggestions have been put forward from time to time with reference to uniting in one department the electrical functions now performed by various Government Departments. While agreeing that some advantage would probably be derived from uniting the several powers in the hands of one department, the Council are doubtful whether the scheme would prove altogether practicable. They further think that the disadvantages attaching to the setting-up of any fresh Government Department would outweigh any advantages there may be. At the same time, they think that it would be well to strengthen the technical side of the Board of Trade. If any changes are made, they hope that nothing will be done to relieve the departments of their responsibility to Parliament. Regarding the first three matters dealt with in the report, Parliament will look very narrowly into any suggested alterations of general legislation before conceding them, more especially if the same legislation applies to any other industry. As to the last matter, no one need trouble. The departments concerned will see that they are not shorn of any power that they themselves value.

Calorific Standard in Indiana.—The Indiana (U.S.) Gas Association have filed a petition with the Public Service Commission asking that the caloric standard for artificial gas, previously fixed by the Commission at 600 B.Th.U., be lowered to 550. The petition covers 29 companies operating in Indiana, and sets forth that, on account of the scarcity of gas-making materials, it it practically impossible to produce gas which will come up to a 600 B.Th.U. standard, regardless of the exceptionally high cost of such material. The petition also points out that in 1913, the Association requested that the standard be fixed at a lower point, and the Commission replied that the 600 B.Th.U. standard was understood to be tentative, and that the question would be reopened at some future time after the gas companies had made an effort to maintain the standard then established.

Chemical Industry of Japan.—One of the most remarkable features of the economic development of Japan, says the "British Trade Review," is her extraordinary progress in the chemical industry. At the commencement of the war this industry was still in its infancy; yet to-day Japan is exporting chemical products for the supply of which she was but three years ago almost entirely dependent upon outside sources. Among many other things, Japan is making sulphate of ammonia from the bye-products of the gas and coke factories and from nitrogenous lime. The Tokyo Gas Company are making carbolic acid; and the Japan Dyestuff Company have laid plans for manufacturing it from benzol. The yearly production of sulphuric acid in Japan is little short of 750,000 tons; and it is intended to establish plant for the production of this acid by the contact process. As to the dyestuffs industry, the Japan Dyestuffs Manufacturing Company has been founded, and is backed by the Government. Before the war Japan imported from Germany coal-tar colours to the value of something approaching a million pounds sterling; and, although the Japanese industry is still in its infancy, it is clear that Japan does not intend to go on paying such a tribute to Germany.

THE INSTITUTION OF GAS ENGINEERS.

AFTER THE MEETING.

By NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

YEARS go by, members assemble at the annual meetings, shake hands, sit out the programme, and separate for another year, probably with mutual congratulations on having held a good meeting. But are we to assume that a muster of 25 p.ct. or so of the total membership necessarily carries such a conclusion? A popular President can guarantee as much without any other attraction.

Whether it is a "good" meeting in a fuller sense, as having been attended with adequate progress according to the needs and new conditions of the times, is open to question. A good meeting comprises something more than a dreary sitting out of the proceedings in the meeting, varied occasionally by a convivial smoke with a crony in the lobby outside. Evidence is to be sought for not only in the direction of something attempted, but also of something done, for the general advancement of the profession or the industry, according to individual ideas of how much, or how little, the Institution is supposed to represent, and to the efficient accomplishment of well-considered designs to this end. But the progress during the last forty years—with the one exception of the formation of the British Commercial Gas Association—has been more on the lines of suggestion and indefinite speculation than of active work; and in this wider sense, the "good" meetings are few and far between. Each succeeding President seems impressed with the fact that the Institution has not risen to the occasion, and offers various ideas as to extension and improvement. The need for decisive and representative action increases year by year, and is greatly accentuated by special war conditions. But the chief features have been, and yet are, uncertainty and indefiniteness of aim. Surely it is time that questions such as "should the membership and scope of operations be extended, so that the Institution may become fully representative of the gas industry rather than the gas engineer?" or "is a gas building required; and, if so, how are the necessary funds to be raised," or "would an experimental gas-works be an advantage, and how can the use of one be secured," should no longer be treated as of the "gigantic gooseberry" class, but be definitely settled once and for all.

Judging from the proceedings at the recent meeting, a home for which was provided by the courtesy of the Institution of Civil Engineers, the members as a body cannot be accused of undue verbosity, notwithstanding the numerous problems by which they are to-day confronted. Some 260 out of a total of 870 devoted the greater part of a day to hearing the proceedings; but excluding purely formal business and the remarks offered by non-members, the number of speakers from the body of the hall did not exceed a dozen, including those who merely put short questions. Possibly the issue of reply circulars, such as those referring to the life of meters, may have exhausted informative powers, though the annual report, including proceedings of Special Committees, covered many items in respect to which a goodly number among the 260 might be expected to have something to say. The limited time at disposal may also be a contributing cause. But the chief item was an obvious unwillingness, not peculiar to this meeting, to take too much licence in the discussion of department reports. Frequently these include matter that would not pass unchallenged if presented in the form of a paper. Complimentary agreement is to a large extent superfluous, and an adverse critic does not receive much patience from the body of the hall, where he is evidently regarded as a sort of Adullamite. Yet surely some of the 90 p.ct. or more of the members who contribute nothing towards the proceedings, and whose voices have not been heard in the meeting room, are capable of supplementing some of the information from their own personal experience. To meet the needs of those who are "unaccustomed to public speaking," or not present, written comments or addenda might be invited, to be included in the published reports. It is doubtful whether much response would be forthcoming, as the majority appear to accept the Committee reports as sharing in the courtesy customarily extended to inaugural addresses.

One may be reminded that the stress of war conditions does not leave much leisure for the preparation of communications, or thinking out discussions, and that if papers were submitted they might not be adequately discussed. But why should the Institution be exceptionally situated in this respect? The District or Junior Gas Associations, or the Commercial Sections, are able to maintain a normal standard. It seems that the department report has entirely displaced the time honoured paper and discussion, hitherto accepted as the best method of disseminating technical information among the members, which is a leading item in the objects of the Institution; and if we deprecate the paper and discussion as not a great loss, we get near to the suggestion that the members are not capable of originating or considering matters of general interest and importance to the profession, and to questions affecting the practical utility of attending meetings.

The time when the "engineer and manager" stood as the representative of the whole technical staff, and when some justification existed for the supposition that an association composed exclusively of such could claim to cover the whole department, has long since gone by. But even in the earliest days of the British

Association of Gas Managers, the need or advantage of lectures or papers from non-members became an important feature in the proceedings; and why should we assume that a gentleman who, by reason of education or employment, is able to present a valuable contribution to the proceedings, would not in a general way be an acquisition to the roll of membership? In many directions he would be capable of bringing in vitality and influence of a character that are outside the capabilities of a manager.

As the industry expands, the manager tends to become more of an organizer and less a technical specialist. This drifts towards the heads of departments, who are closer in touch with details than the so-called head. The manager has long ago ceased to cover the whole technical department with his own hat, but depends on the works foreman, the distribution superintendent, the sales superintendent, and others with technical knowledge in their special department exceeding his own. Many of them, being younger men, have enjoyed educational advantages that have only come into existence within the last twenty years. Men who would be a great assistance to the objects of the Institution (in the narrow sense) have been left to form independent Associations, and incidentally have shown that they are capable of providing papers that, in respect to interest and informative quality, are quite equal to anything that has been put before the Institution. The District Associations, though now affiliated to the Institution, were allowed to go their own pace for so long a time that they retain their distinctive characteristics, especially in regard to the Commercial Sections. One might go on to mention the Gas Companies' Protection Association, the Sulphate of Ammonia Committee, the London Coke Committee, &c.

Now and again the weaknesses due to lack of homogeneity become evident, and lately we have an endeavour to meet the need by the appointment of a National Council, at which all may be represented. What advantage is gained by so many different bodies, which must unavoidably overlap and clash in some respects? The membership must be drawn from the same sources, and it is impossible for one individual to take a living interest in, to attend meetings, or share in the proceedings of, half-a-dozen Associations; and the success or otherwise of each body becomes dependent upon two or three leading individuals. If this is an advantage, the average member becomes simply a man of straw. And is it sufficient to outset the very obvious disadvantage due to lack of prompt representative influence and united effort? The old proverb about the bundle of sticks still holds good.

RATIONAL UTILIZATION OF FUELS.

In the current issue of the "Journal of the Society of Chemical Industry" an abstract appears of an article by N. Caro in the "Chemiker Zeitung," Vol. XLI., pp. 393-5.

The abstractor writes: The rational utilization of fuel has excited much attention in Germany recently—especially in connection with the proposals for the taxation of fuel and electrical power. In some quarters, the carbonization or gasification of the whole of the coal used is advocated, with prohibition of the combustion of raw coal. For many purposes the latter can be regarded as an unnecessary and old-fashioned process, while the former, by reason of the bye-products obtainable and the hygienic and other advantages which follow, should certainly be widely developed, in the interests of true national economy. A note of caution, however, is sounded against rash generalizations from special cases which are frequently current. If all the coal were carbonized or gasified, the production of bye-products would exceed any demand that can be anticipated at present. After the war there will be available large supplies of synthetic nitrogen compounds, which will inevitably prevent the maintenance of the price of ammonia at the pre-war level.

The question of the rational utilization of fuel is to be studied from an economic standpoint. There are cases where, on this ground, the direct combustion of coal is preferable and more economical in fuel than gasification or carbonization. In carbonization there is a thermal loss of 10 to 15 p.ct.; in simple gasification, of 15 to 20 p.ct.; and in gasification for bye-products using steam, the loss may rise to 30 to 50 p.ct. These losses must be reckoned with in comparing the thermal efficiency of methods of utilizing coal. As a result, the fuel consumption in raising steam or heating certain furnaces may be increased by substituting gas-firing for coal-firing. Nevertheless there are numerous cases where gas-firing shows such marked superiority in the performance of a particular operation or sometimes an exceptional thermal efficiency, that this heat loss in gasification becomes of quite minor importance.

Thus where cleanliness of operation is essential, or where high temperatures must be developed, or where the grade of fuel is unusually low, gas-firing may be preferable. For boiler-firing these factors are inoperative; and no economy of fuel is normally effected by previous gasification of the coal. Owing to the greater heat loss in the producer, gasification with bye-product recovery leads to still smaller thermal efficiency in heating operations, and then the choice is decided by the value of the bye-products—a very uncertain factor, perhaps, in the near future. This and the lack of a supply of suitable cheap coal has militated against the development of the Mond gas process in Germany though it has established itself in a few places under specially favourable conditions. Even in England (South Staffordshire), where conditions are exceptionally favourable, the central generation and distribution of Mond gas made only slow progress for many years.

The gas-engine is thermally more efficient than any form of steam-engine; so that fuel economy can be effected by gasification of the coal combined with the use of the gas-engine as prime mover. This economy can be increased by using the exhaust gases from the engine in the producer, when the thermal efficiency of the latter rises to 80 to 85 p.ct. (with bye-product recovery). Unfortunately, the capital cost of the gas-engine is so high, and its flexibility under load so low, that it cannot for the present compete favourably with the steam-turbine for power production. This may be changed in the future, more especially if the problem of the gas-turbine is solved.

The author concludes that no saving of fuel will be achieved by central gasification; and, in view of the possibility of fuel taxation, proposals to carry this out at the present time are premature. He regards it as preferable to allow the question of gasification of fuel prior to burning to be decided by the unfettered judgment of industry following its normal technical development. The expenditure of heat in carbonization is less than in gasification; and to that extent it can contribute more to fuel economy. Furthermore, the range of bye-products is greater. Wherever circumstances (technical and economic) permit, national economy will be promoted by this treatment of coal. It must be remembered, however, that low-temperature carbonization, liquefaction of coal under pressure by means of oxidizing and reducing agents, and the physical and chemical treatment of coal, may possibly bring in the future new methods of utilizing fuels which can be advantageously adopted in the interests of national economy.

A NOVEL GAS BILL CHART.

The American "Gas Age" say they have received from Mr. W. F. Schaphorst, of New York, something new in graphical estimation of how much the gas bill would be without doing any figuring. The following explanation of the suggestion is given.

No matter what the rate per 1000 c.ft., and no matter what the number of cubic feet up to 10,000, the chart will estimate the amount pretty closely. It is not as accurate as a mechanical multiplying or dividing machine, or anything like it; but it is a "gas-computing device" that has been reduced to a simple operation.

For example, what would be the bill for 800 c.ft. of gas at 80 c. per 1000 c.ft.? Find the 800 (Column B), and then find the 80 (also Column B). Now find the point that is exactly halfway between them. That is easily done by simply folding a strip of paper. Place one end of the strip on 800, the strip being on the "Cost of Gas" side of the scale; then fold this end back to 80, and crease the fold. At this crease will be found the cost of the gas used. It will be noted that the "Cost of Gas" scale condenses as the amount increases, and that the cost in the problem is halfway between 60 and 70, but that the decreasing scale makes this 64 instead of 65 [$0{\cdot}800 \times 80 = 64$]. Or, if you have a pair of dividers or a ruler, the halfway point can be found in that way. The strip-of-paper method is the quicker, and is highly accurate.

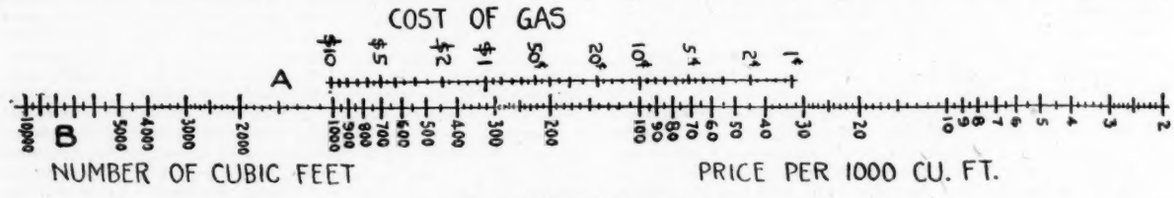


Chart for Computing Cost of Gas.

Dividend of the Tottenham District Light, Heat, and Power Company.—The Directors recommend payment for the half year to June 30 last of 5 p.ct. per annum on the consolidated preference stock, and of the full statutory dividends of 5½ p.ct. per annum on the "A" consolidated stock and 4 p.ct. per annum on the "B" consolidated stock—all less income-tax. A year ago the dividends were: On the preference stock, at the rate of 5 p.ct. per annum; on the "A" stock, at the rate of 7⅛ p.ct. per annum; and on the "B" stock, at the rate of 5⅝ p.ct. per annum—so there is a better return on the present occasion.

SOCIETY OF CHEMICAL INDUSTRY.

Annual Meeting in Birmingham.

THE Annual General Meeting of the Society of Chemical Industry, which was held in Birmingham on Wednesday, Thursday, and Friday of last week, took the form of a congress on the progress of chemical industry and applied chemistry. The whole of Thursday morning was devoted to a discussion of various aspects of gas supply; but a number of other matters of more or less direct interest to the gas industry also came under notice. Mr. CHARLES CARPENTER, D.Sc., the President of the Society, was in the chair throughout the meeting.

A WELCOME.

On the first day, the Society were welcomed by the Right Hon. the Lord Mayor of Birmingham (Alderman A. D. Brooks).

The LORD MAYOR, after recalling the fact that the Society had met in Birmingham on a previous occasion—in 1907—drew attention to the necessity for every man, whatever his attainments, to place his abilities at the service of the State in the present crisis. He gathered that one of the objects of the meeting was to see how far chemists could assist in the prosecution of the war, as well as to consider how they might be able to help the country in the days after the war. For the time being chemists were concerned in seeing how far they could destroy human life; but the experience would be of enormous advantage after the war. They had the means and the ability of preserving and making use of the knowledge thus gained for the benefit of the nation. Many industries which had temporarily been suspended would have to be re-established; and in order to conduct the national and commercial affairs on sound and economical lines, every use would have to be made of the scientific and technical methods available. Many industries in Birmingham depended largely for their success on the recovery of what in the past had been termed waste products. A great deal had been done in this direction, but still more remained to be done. There were, for instance, certain kinds of coal which it was not profitable to use in the ordinary sense, but which might be made profitable use of if chemical methods were applied. Again, there was, in a centre like Birmingham, a large amount of waste heat passing up the chimneys and into the air, which might be recovered. These were directions in which they would have to build afresh the national prosperity. In Birmingham, there were large municipal gas and electricity undertakings, in which considerable progress had been made by the application of scientific methods. In addition, there were the various manufacturers; and he was sure Birmingham would watch with considerable interest the results of the meetings.

PRESIDENTIAL ADDRESS.

Mr. CARPENTER, in the course of his address, said: We meet to-day in a city renowned as being essentially material and practical in its character. It would not, indeed, require a great stretch of the imagination to look upon this gathering as a pilgrimage to the shrine which will ever be associated with the memory of two famous men—the discoverer of oxygen, and the inventor of the modern steam-engine. The mechanical engineer will not be likely to dispute the influence of Watt, nor will the analytical chemist be likely to deny indebtedness to Priestley. It is true, our present-day vision of the future is not quite the same as that which illuminated the minds of these two great men. But the steam-engine the one designed is just as essential an adjunct of the modern power plant as is the chemistry practised by the other to the modern synthethizer of new substances.

With the future of our Empire is closely bound-up progress in applied science, and of a certainty, chemical science; and this progress is impossible of achievement without the complete and sympathetic collaboration of both chemist and engineer. With one or two notable exceptions, this was not recognized to the full by many manufacturers in this country certainly until recently. The progress of the chemical industry requires the inspiration of the chemist in all possible directions. This, of course, goes without saying; but what I do urge is that the greatest possible advantage be taken of the engineer's particular gifts to bring about its achievement, once he is made to understand the conditions to be aimed at. The task may not be an easy one, for the temperaments of the chemist and the engineer are dissimilar, and the best examples of both are rarely met with in the same individual. The sorting-out process should begin at school. It should not be left to chance for the lad whose natural bent is along either of two paths, to make his choice of one. If the teaching authority has properly guided and taken pains, it should be an easy task to sift the pupil's leanings and direct his course in accordance with them. As a preliminary step towards this, the first principles of experimental science should be compulsorily taught in primary schools, as, for instance, is drawing.

Fortunately, the task of those who are endeavouring to push science into the forefront of our educational system is made simpler to-day by the fact that we have no longer to argue the necessity—I might almost say the paramount necessity—of the chemical industries to the nation. But how are we to take full advantage of the latent capacity of our youth unless we teach one and all that the pursuit of chemical knowledge is a calling as honourable and praiseworthy as that of any other of the professions? We have all, I expect, come across men with a strong, natural interest and ability for chemical pursuits which they followed by the merest chance, and not as a matter of course. Their rising to important positions in the chemical industry should have been by design rather than by accident. Here is one of the cases where the community require, and is entitled to have, the help of the State. Our educational system needs alteration at its foundations. In my opinion, a boy is old enough to learn science when he is old enough to learn history and geography. When a boy reaches the age of sixteen he should commence work either at the desk or in the factory, with compulsory attendance at continuation schools. After two or three years he will, if showing himself to possess the necessary ability, be fit for entrance to the University, to follow a further course of study along paths adapted to his temperament and qualities.

In coming into contact with men holding important positions in this country, I have been struck with the remarkable fact that, although they have been qualified to deal with affairs—they have been responsible for building-up large businesses, they have been responsible for controlling large organizations, they have played important parts in the government of the country—they overlook the enormously important fact that the bulk of the country is after all made up of the working classes, and they have not the slightest idea how to manage and deal with them. The fault is because they have had no opportunity in their early training for getting into close and personal contact with the men; and I think this can best be done in the early stages of a lad's life. I think that at sixteen a lad is perfectly ripe to receive the impressions of humanity which are going to be of importance to him in the future, whether he is to be a control chemist, a manager of a works, a member of Parliament, or even in the Cabinet.

In the past, the nation's youth has been developed as unscientifically as its fuel resources. We have seen enough during these last three years to realize that our future depends upon the highest development of our industries, and in which the whole populace must be trained to take its share as a pleasure no less than as a necessity. The taunt that we were a "nation of shopkeepers" was fast becoming a fact when our rude awakening came a century later. If we ever deserve another such rousing, our sleep will prove eternal. There were doubtless many contributory causes; but the plight of chemical industry in this country was principally due to the fact that so small a part of the nation was taught its language. The nation cannot be expected to appreciate science at its true value unless the appreciation is inculcated as thoroughly as patriotism, for instance. It must be remembered that the industrial chemistry of to-day is not largely a matter of pots and pans, but a highly complex combination in which temperatures and pressures of fine gradations and extended limits play important parts. The more one sees of this position, the more imperative does it appear that the chemist and the engineer should get into double harness as quickly as possible—the very faults of each make him indispensable to the other. The chemical industry teems with examples where the collaboration of both has been successful in extending its fields of usefulness. Take, for example, what is perhaps almost the oldest—that of glass-making. It is the engineer who has made possible the large-scale manufacture of jars and bottles to an extent that was quite out of the question as long as human beings and hands were required to blow and fashion them.

The importance of the chemical industries in the scheme of national defence and national progress is at last becoming understood, and must be taken into account in the refashioning of our educational system. Another essential change is in our knowledge of the raw material resources of the Empire. Possession of the better maps contributed to the successes of the victors of 1870. And it must be a State matter to map-out all our mineral resources, that they may be placed at the disposal of industry by, and I have come to the conclusion under the control of, the State. I cannot picture a future in which it is possible to work our mines, for instance, with regard only to the present, or in which anything but a surplus output goes abroad before home requirements are satisfied. It should be an offence to supply coking coals for ships' bunkers, even though the price paid is a good one. The State must consider whether it is better to export coal for steel-making by our competitors, or to send them the finished article. If we do send our raw materials abroad, their sale should be made a matter of inter-State exchange and barter. It ought to be possible to make a beginning by exporting coke instead of coal, and so increase our control of bye-products, the need for which is rapidly increasing. We should thus work-up the nitrogen content of our coal, and export this instead of the mineral, which should be recognized as the property, as it is the heritage, of the nation.

It has been a matter of deep regret to me that my recent year's holding of an office which I highly value has been an even more troublous and anxious time than its predecessor. The country will never know, still less repay, its debt to this Society. It has pursued its way for the most part unheeded and unrecognized, save by the few here and beyond the seas who know its worth. To-day its star, as is that of the industries it represents, is in the

ascendant; and with this growth your Council are ever on the watch that its usefulness shall keep pace.

A VOTE OF THANKS.

Prof. HENRY LOUIS, in proposing a vote of thanks (which was heartily accorded), said that Mr. Carpenter was an example of how thoroughly well a scientific man could be trusted to take charge of the economic and administrative affairs of a big organization. The scientific man had been looked upon as living too much in the abstract, and not being able to descend from this nebulous region into the region of hard solid fact. The Society had been fortunate in having him at the helm during a period of great development in its external and internal policies, and particularly at a time when the whole nation had awakened to the fact that every industry was a chemical industry. It would be the task of the Society to see that the nation did not again sink into a state of apathy with regard to science. Personally, he thoroughly agreed with Mr. Carpenter in his views on education. He had for a long time advised every lad who reached matriculation standard to go into the engineering workshops for six or twelve months, because he was quite convinced that, whatever a lad was going to be in after-life, this was about the best bit of practical education he could have. So far as the working classes were concerned, he was glad to see that employers were realizing that high wages were to the benefit of both employed and employer. The salvation of the country lay in high wages and an honest equivalent in work; and the working classes must be convinced of this. He was also thoroughly in agreement with Mr. Carpenter's desire to see the resources of the country in raw materials properly organized and dealt with; and great satisfaction was to be derived from the fact that a Committee had been sitting to advise on the appointment of an Imperial Bureau of Mineral Resources. This was a very hopeful outlook for the future.

REPORT OF COUNCIL.

The report of the Council (which was adopted) stated that Prof. Henry Louis, of Newcastle-on-Tyne, had been nominated as President in succession to Mr. Carpenter. The Council recommended an increase in the annual subscription from 25s. to 30s. Dr. Rudolph Messel, F.R.S., has been re-appointed to serve on the Governing Body of the Imperial College of Science and Technology for a further term of four years. The Council have appointed two representatives to the Refractory Research and Standards Committee recently formed, in order to consider the co-ordination of research work on refractory substances, and to endeavour to secure joint action in carrying further the work of standardization.

A resolution with regard to the increase of the subscription, as set out above, was passed after a short discussion.

The PRESIDENT explained that the object of the proposal is to provide better office accommodation in London for the staff, and also to meet the expenses of the extension of the Society's "Journal." As to the possibility of a building in London which will provide a rendezvous for the chemical industry as a whole, Mr. Carpenter said the Society would be pleased to discuss the matter with the Chemical Society; and he was gratified to hear that the latter would shortly be going into the question.

The reading of papers was then taken in hand. Abstracts of those of more particular interest to readers of the "JOURNAL" follow, with a report of the discussions. It may be mentioned here that opportunity will be taken to reproduce some of these papers in full, as soon as they are released for the purpose by publication in the Society's "JOURNAL."

SOME OBSERVATIONS ON THE TEXTURE OF FIRE-CLAY.

By WALTER C. HANCOCK, B.A. (Cantab), F.I.C., and W. E. KING, A.R.C.S.

This was a brief account of some experiments on a typical Stourbridge fire-clay, with a view to making a comparison of the properties of the raw and the fired material; the idea being to afford some link between the two states, or indicate something of the physical changes which occur on firing. The results were given in a number of tables. It is not suggested that from a set of observations upon one single clay general conclusions can be drawn; but the tables showed that the "clay substance" or material approximating to that represented by the "kaolinite formula," as might be expected, composes the bulk of the finest grained fraction, and the quartz tends to accumulate in the coarser fractions.

Discussion.

The PRESIDENT said he had been particularly interested in the question of refractories, having regard to the difference in procedure between manufacturers here and manufacturers abroad in the system they adopted to arrive at the finished article. He would not say that the difference was a present-day one, because scientific methods were now being adopted in this country by all manufacturers of refractories on a large scale. It seemed, however, that the old method adopted was to take a clay, which, after a due amount of weathering, was mixed with a certain amount of grog; and this was the end of it. That was the Englishman's idea of building-up a refractory material for industrial use. The German idea was quite a different one. They arrived at what the ultimate composition of their clay should be; and they fortified their raw material in order to provide the ultimate composition. In this way, they were able to secure fire-clays which competed with ours, although in some cases the Germans did not possess in their own country all the materials necessary to produce them. The final article which they turned out in this scientific way was, for practical work, better than anything which for a long time the British manufacturer was able to produce. However, as a result of the awakening which he had had, in common with others, the British manufacturer was now altering his methods, and was producing something which was better. But, as far as his own experience went in the refractories in which he was specially interested, he had not yet succeeded in making an article as good as the German one. There were a good many little snags to come in yet; but no doubt the British manufacturer would achieve complete success in the future. He had made considerable progress, but had not yet achieved the point which the Germans had reached when war broke out.

INDUSTRIAL FUEL FROM GAS-WORKS.

By E. W. SMITH, of Birmingham.

When the author was originally asked to read a paper on this subject he had hoped to be able to put forward results and certain experimental work then in progress, on the heating of retort-settings by means of external producer gas, and also the use of blue water gas put through ordinary retorts during the process of carbonization, and comparing this with the dilution of coal gas by blue water gas not by means of retorts. However, all these plans were upset by the Ministry of Munitions taking over the plant for other experimental purposes. The paper, therefore, consisted of a series of comments and data on a few important facts and points relating to the industrial use of gas.

Notwithstanding the increasing recognition of the value of coal gas as a fuel for all purposes, and the hopes felt by many people that the use of raw coal for certain purposes might be prohibited, there were still many prejudices to be broken-down. As some indication of the progress that is being made nevertheless, it was mentioned that for the year to March 31 last, the Birmingham Gas Department had supplied 11,000 million c.ft. of gas, 10,000 million being from the carbonization of over 800,000 tons of coal, the remainder being water gas, carburetted for the most part, and produced from nearly 5 million gallons of petroleum oil and 37,000 tons of coke. Nearly 80 p.ct. of the total supply was for power purposes, industrial and domestic. Of this, 20 p.ct. was for industrial heating processes, and 14 p.ct. for motive power. The increase this year since March 31, due almost entirely to heating processes, was 11 p.ct. compared with the corresponding period of last year. The 800,000 tons of coal yielded nearly 570,000 tons of coke, of which 16·55 p.ct. was used for fuel on the works, and the remainder—viz., 487,000 tons—was available for sale. The tar produced amounted to 24 million gallons, from which was obtained benzol, and over 8 million gallons of creosote for boiler-firing—such as was used, and would be used more extensively in future, in the Navy.

The national aim should be to use coal, so that the maximum value was obtained. Even if coal distillation were to cost so much that the net value obtained might be slightly less than the net value obtained by the direct burning of coal, the indirect value to the country in the way of residuals would justify the increased cost. In other words, it paid to carbonize coal rather than to burn it.

The gas industry distilled coal for gas; and the value of the bye-products went to reduce the price of gas. There was no reason, however, why the primary object should be to produce gas. For instance, at the Saltley Gas-Works of the Birmingham Corporation there was an installation of sixty-six blast-furnace ovens producing an excellent blast-furnace coke. These ovens were heated by external producers, the fuel for which was the dust on tips for which there was little sale. The fuel as used consisted of 70 p.ct. of slack; and there was recovered 45 lbs. of sulphate of ammonia per ton. There was a considerable demand for special grades of coke; and the department had installed extensive coke-screening plant.

Then there was the question of briquettes, which were very little used in this country—largely because they were too dense to burn without a large amount of induced draught, in consequence of their cost and their friability under heat. Results, however, had now been obtained which seemed to indicate that these troubles had been almost entirely overcome. [Presumably, Mr. Smith is referring to the briquettes made on the process devised by Mr. Lovell, and recently described in the "JOURNAL," as he stated during the discussion that the Birmingham Gas Department are not actually making them.]

Coke contained sulphur, not only fixed but combustible; and coke containing not more than 0·3 p.ct. of combustible sulphur was being used for fires in the trenches in place of charcoal. Attention should also be given to the tar, of which 10 gallons were obtained per ton of coal. The composition varied with the type of distillation plant. Used under a boiler, 1 lb. of creosote would evaporate 11·24 lbs. of water, or nearly twice as much as could be obtained from coal. In using creosote, special burners were used, requiring from ½ lb. to 3 lbs. pressure per sq. in. Used in this way, extremely high temperatures could be obtained.

Gas was, of course, the most important fuel for the gas-works; and the tendency was to standardize the quality in terms of calorific value. Over 90 p.ct. of the gas used for heating purposes—including incandescent mantles—was now supplied on a calorific value basis; the general minimum standard at present being 500 B.Th.U. It was impossible to find from public records, however, what determined this standard, and what were the economic and scientific reasons for it. So far, it had not been possible to produce such a quality of gas from the average coal and using

the usual methods of carbonization, though this quality had been turned out by a number of gas-works.

It was significant that railway companies, as large consumers, were now taking a keen technical interest in gas supply. They had suggested that there should be a limit to the amount of inert gases allowable in town's gas. This might be another means on their part of ensuring a higher quality for the calorific value. There was no doubt the companies would not be satisfied with a good quality blue water gas of 300 B.Th.U., even if in that case the inert gases were less than in a good coal gas. If 500 B.Th.U. were agreed upon as the standard, unless a good quality blue water gas were used for dilution, the inert gases were bound to be high, and the flame temperatures would consequently suffer. Nevertheless he had seen a cupro-nickel furnace, doing 250 lbs. of metal per heat, working with blue water gas of 300 B.Th.U. at a temperature of 1700° C., and the B.Th.U. per pound of metal compared favourably with those when using a good coal gas.

The Heating, Lighting, and Ventilating Committee of the University of Leeds and the Institution of Gas Engineers were now making a study of this question. They were making a practical effort to evaluate gas of varying qualities and composition for different purposes. The range of qualities would be a wide one; and the results should make it very much easier for the gas engineer to decide what gas he should make to give the greatest service to the consumer. Certainly, the best measurement of gas, so far as the consumer was concerned, was on units of power rather than volume. Too high a quality was as bad as too low a quality. Variations, too, were bad; and although it was not possible, in his opinion, to obtain a coal gas or town's gas with a less fluctuation than 10 B.Th.U. either way during a day's run, still that would not affect a heating proposition, because there were many other difficulties that militated against a good service of gas. However, after the war, when it was possible for statutory standards to be again observed, the consumer should have little of which to complain.

Dealing briefly with the question of internal or external producers for retort-settings, Mr. Smith said the former were not usual, but they had certain advantages. The fuel was fed hot direct from the retorts into the producers in the case of horizontal and inclined retorts. With vertical retorts, the coke was fed cold into the producer. Then the producer gas was passed immediately from the producer into the retort-setting, thus conserving the sensible heat of the gas for heating the retorts. The radiation losses from the producer could be largely ignored, as the producer was surrounded by the setting being heated. The capital cost was less than with external producers.

Some of the drawbacks were, the large amount of labour in looking after the fires, and, if poor coal was carbonized, poor coke was produced, heats suffered, and still worse results were obtained due to bad fuel round the retorts, and the life of the setting was likely to be reduced. The quality of the gas produced, however, when working under satisfactory conditions compared with that of the external producer. The calorific value was 112 B.Th.U. net; the make of gas per ton was 10,000 c.ft.; the coke was 10 cwt. per ton of coal; the temperature of the producer gas before combustion was 1000° C.; and the sensible heat in 1 c.ft. of the producer gas was 29 B.Th.U. Therefore the total heat entering the setting per ton of coal carbonized would be $112 + 29 \times 10{,}000$. Although this matter had been given considerable attention to in recent years, very little data had been published; but from experience which he had had during the last few months with very large muffles, in which the producer gas was not preheated, the temperatures obtained in the muffles were such as to make it quite possible to heat-up retort-settings without external producers.

The last point dealt with was low-temperature carbonization. There seemed to be no general agreement as to the object of commercially developing low-temperature carbonization. The experimental work of experienced research chemists indicated the great difference in the results obtainable by high and low temperature carbonization. Those who had attempted to extend low-temperature carbonization from the laboratory stage to practical working had varied in their aims. Some had hoped for high benzol yields, and others had anticipated high tar yields, to justify the process. Others had had as their main object the production of solid fuel that would burn easily in the domestic grate without producing smoke. Those who were in the closest touch with many of the processes that had been, and are being, tried agreed that so far no really reliable results had been obtained. That, however, did not mean there was nothing in low-temperature carbonization. He did not believe there had been sufficient competent research work carried out to enable anyone to pass an opinion either way; but if one judged by the average published results, and particularly recently published results, no more would be heard of the process. The paper by Mr. M'Laurin, of Glasgow, was typical of the kind of thing he meant. It seemed to him a pity that such an important subject should so far have been left in such hands; and the paper he had mentioned might almost be taken as typical. One of the chief claims for low-temperature coal distillation was that power stations could be put up at the pit's mouth, and that domestic fuel could be produced—the gases being used for power generation, which could be distributed over long distances. The chief advantage of this method would be that it centralized carbonization and power production; but it decentralized the domestic fuel that had been produced. It seemed to have been overlooked that the volume of coke produced was very considerably greater than with high-temperature distillation; and as the coke would have to be distributed in small quantities as consumers desired, the question of freightage was important. Again, if a balance-sheet was drawn-up of the actual figures published so far, and the tars that were made were examined, it would appear that the cost of washing for the light spirits for motor and other purposes was such as almost to neutralize the value of the increased volume of tar obtainable by low-temperature distillation.

The chief disadvantage so far as could be seen from the regrettable lack of information on the subject was that power was being thrown away. Low-temperature carbonization gave about 5000 c.ft. of gas per ton of 500 to 600 B.Th.U. gas. Compare this with 12,000 c.ft. per ton of similar gas from high-temperature carbonization, and it would be seen that 30 to 40 p.ct. of actual power was being wasted in the form of gas. The power was left in the form of solid fuel.

There was a strong case for the Government or some competent authority to set up a scientific and practical Committee, versed in the conditions of carbonization, to go into the whole subject (even if at considerable cost) in an independent manner, so as to settle it as far as was practicable at the present time.

Discussion.

The PRESIDENT, referring to the last remark in the paper regarding the appointment of a scientific and practical Committee to go into the whole subject of coal carbonization, said it was a satisfaction to be able to say that one of the activities of the new Government Department of Research would be in the direction of investigations similar to those suggested. The Fuel Board, which was a branch of the Research Department, had decided that the matter was so important, and that the opportunities for arriving at the true conditions so unsatisfactory, that it was a matter of national importance that absolutely unimpeachable experiments should be carried out. In other words, it had in the present state of affairs become a duty of the State to see that the fullest possible information with regard to the utilization of its fuel resources was made available for the nation at large. This was quite a broad-minded view to take, and was one that we should hardly have expected to have happened some years ago. It was nevertheless the fact that negotiations were in a fairly forward state with regard to the preparation of land for the erection of the necessary works.

Professor HENRY LOUIS said he could only speak on generalities, as in the absence of a copy of the paper it was impossible to keep the figures in mind for the purpose of criticism. The point of greatest importance was the need for so dealing with fuel as to get the maximum value out of it. In using such an expression we must be clear as to what we meant by "value." It could be taken from many points of view. Coal could be treated in order to get the maximum pecuniary value out of it, and yet not to secure the maximum benefit for the nation. On the other hand, it was perfectly possible to treat coal so as to get the maximum power value out of it and again not secure the maximum benefit possible. It was a very complex question indeed, and enormously difficult to determine, as there were so many different factors to be taken into account which were not fixed factors. He was pleased to hear that the briquetting of coal slack and coke slack was receiving serious attention. He had for some time been urging it on the authorities that they should pay attention to this form of patent fuel. Patent fuel had never caught on in this country as it had on the Continent, simply because we had had good and cheap coal all through the country. There were, however, a certain number of works making patent fuel; and, speaking from memory, he believed three-quarters of it was exported. At a time like this, however, it seemed to him that coal control should become an actual fact and not a mere phrase, and that we should have coal depôts established at all big centres to deal with the accumulations of dust by setting up patent fuel factories. There was likely to be a pressing demand for coal in the large centres of population in the coming winter. Pitch, to put it in a mild way, was not dear; and the present waste of coal and coke dust which was going on could be prevented if energetic steps were taken in this direction. He was glad to know that the manufacture of briquettes was not being overlooked in Birmingham, and sincerely hoped that other centres of population would follow this lead. This was one of the pressing economic questions of the moment.

Mr. W. J. A. BUTTERFIELD agreed with the author that one of the most important questions to be considered is the quantity of inert gases permissible in a public gas supply. It was one of the signs of the healthy condition of the gas industry that there was now to be an inquiry from within into this very question; and they might anticipate before long that the gas industry would recommend gas undertakings, of their own initiative, to keep the quantity of the inert gases within reasonable bounds. One of the most prominent gas engineers in the country, whose name he would not mention, had for years past made it a practice to keep the inert gases within 10 p.ct. This, perhaps, was a rather lower limit than many gas undertakings, who used water gas, were prepared to accept. There was no question, however, that some such limit—say, 2 or 5 p.ct. higher than that—must shortly be recognized as the maximum permissible. The question of the use of water gas in public supplies was not so much whether it should be allowed, but that it should be used approximately in uniform proportions. It was an intolerable nuisance to a consumer to have 5 or 10 p.ct. water gas one day and 50 p.ct. another. Yet there were some districts in the country where this state of things prevailed. He believed that many consumers would rather pay a considerably increased price provided they had the same uniformity, which could be secured, as in a neat coal gas. He was pleased the author stated that coke briquettes were now a greater success than formerly—the more particularly in connection with low-temperature carbonization, because the coke thus produced was so extremely bulky that the transport costs were very much higher for the same fuel value than with coal. It might be possible to deal with this coke by pulverizing and briquetting it, so as to get a fuel which would have something of the compactness and density of coal. When considering the question of low-temperature carbonization, it must be borne in mind that after all the value of the products

was their fuel value. Their value for any other purpose might not have very much effect on the ultimate results. This being so, it was a question whether raw coal could be turned to the same advantage as the gas coke and tar resulting from carbonization. If coal was pulverized for certain purposes, such as cement burning and boiler firing, it was difficult, in particular cases, to see how carbonization could give any better return. If smokeless and complete combustion could be secured by the use of pulverized coal, he failed to see what justification there was for installing the enormous plant in which to carbonize the coal. Looking at the small units of plant with which many low-temperature carbonization systems were worked, it was a question whether the product obtained represented an ultimate saving of fuel to the nation.

Mr. Drummond Paton protested against the rather disparaging attitude of the author towards those who had experimented with low-temperature carbonization. He himself said all honour to these men. They had worked without return, and their lack of success was not due to themselves, but to gas undertakings and organizations like the Society of Chemical Industry, who should have seen to it that their work was supported more than it had been. One of the difficulties was that all coals had their characteristics, and they could not all be treated on any definite basis. There were many millions of tons of coal in this country which could never be used until low-temperature carbonization came into operation; and this was why the Society should support the men who for ten years had been working at the question. He was one of those who, according to the author, had been getting inaccurate results; but he had spent his life trying to get something done. Take a coke of a pitchy and resinous nature. It was impossible to coke it in the ordinary form of retort; but under low-temperature distillation, in vacuum, a high yield in oil could be obtained. He submitted that the question to be settled was the relative value of the distillates in low-temperature and high-temperature distillation. It was not a question of how many cubic feet of gas per ton was obtained. It was a question of the future of aerial transport, and the supplies of oil which would be required for such purposes; and the highest recovery of oil from coal had been regarded as one of the biggest assets of the country. This oil would be obtained from the coal that was now left in the mines of this country (to the extent of 25 million tons a year) by means of low-temperature distillation. One who had done much valuable, but unrecognized, work on coal characteristics was James Lomax, of Bolton, although he had now in old age been honoured by the Geological Society. It was impossible to tell all that could be obtained from any individual coal in the way of fractions, unless it was studied. In regard to briquettes, these gave 5 p.ct. better thermal efficiency than coal; and as the desire to-day was to save transport, it was surely better to transport briquettes than loose coal. Furthermore, the use of what was at present waste coal was a question of national economy; and briquetting was one way to promote this. If the ash content, however, was too high—say, 20 to 30 p.ct.—it would be impossible to briquette. But such coal could be gasified; and there was no reason why destructive distillation could not be combined with low-temperature carbonization. He had started to work in this direction eight years ago, and had succeeded in carrying the proposition to a practical conclusion in his own county of Lancashire, where they were moving towards a station on a 250,000 c.ft. basis. As regards the appointment of a new Committee or Commission, he suggested that they had on it men who knew something about the subject to be investigated. He had had occasion to discuss the matter with one gentleman on a Committee dealing with coal, and he had confessed that he knew nothing whatever about coal.

Mr. Smith, replying to the discussion, said that Mr. Drummond Paton would be pleased to hear that the Birmingham Gas Department had taken up the matter of destructive distillation. The briquetting system he had referred to was not one that was being developed in Birmingham. By the request of the inventor, however, the briquettes were being tried in the city; and, when he was ready commercially, he would publish his results. He had no intention whatever of casting any reflection on the *bona fides* of experimenters on low-temperature carbonization. What he deprecated was that theirs was the only work. It was an important subject; and work should have been done by men who had probably less experience in coal but more experience in research. The example of results recently published was galling to him, and he personally regretted that the Society's "Journal" saw fit to print the paper in question. As to the briquetting of domestic fuel and low-temperature carbonization, they had to overcome a cost of 5s. 6d. for briquetting; and it must be at a fairly low price before it would pay to distribute them.

Mr. F. R. O'Shaughnessy mentioned that at the Birmingham sewage-works large quantities of tar were being received because the owners had no means of disposing of it. This was a bad form of waste; and it had increased since the war. He believed there had been a great growth of private producer gas plants during the past three years.

Mr. Smith said if these works were on a canal they could easily get rid of their bye-products at a price. Finally, he expressed his regret that the paper was not in print. This was due to lack of time to prepare it sufficiently early.

THE CALORIFIC VALUE OF INDUSTRIAL GASEOUS FUEL.

By W. J. Pickering, of Birmingham.

The author referred, at the outset, to the increasing importance of the test for calorific value of gas during recent years, and more especially since the commencement of the war. He then proceeded to explain the standards of calorific value adopted on the Continent and in this country—stating that, in this country, the standard is the British thermal unit, and that it is usual, in determining the calorific value of a gas, to arrive first at the figure for large calories, and then to express the result in B.Th.U. by multiplying by the factor 3·968. The general acceptance of the Metropolitan Gas Referees' new definition of the "calorie," as "the amount of heat which will raise the temperature of a litre of water 1° C." was remarked upon.

The author then explained the meaning of "gross" and "net" values (A and B), and stated that a growing body of opinion was in favour of the recognition of the "gross" or "total heat value," in speaking of the calorific power of town's gas, for the reason that the "total heat" capable of being developed from the gas, when burned under the best conditions, is the real calorific value. "Gross" value, it was remarked, is usually identical with "observed heating" value; so that it seemed desirable to adopt the term "total heat value," or merely "total heat," in preference to the old "gross value." The "total heat value," it was stated, could be defined with sufficient precision as "the number of British thermal units produced by the combustion, at constant pressure, of the amount of the gas which would occupy a volume of 1 c.ft. at a temperature of 60° Fahr., if saturated with water vapour, and under a pressure equivalent to that of 30 in. of mercury at 32° Fahr., and under standard gravity, with air of the same temperature and pressure as the gas, when the products of combustion are cooled to the initial temperature of gas and air, and when the water that is formed by combustion is condensed to the liquid state." [See Circular No. 48 of the U.S. Bureau of Standards—"Standard Methods of Gas Testing."]

The author then described the two types of calorimeter in general use in this country, and gave a detailed description of the instrument used at Birmingham, as well as the Metropolitan Gas Referees' standard instrument, as designed by Prof. C. V. Boys. He explained that, after the commencement of the war, the supply of calorimeters of the Jünkers type having necessarily ceased, it was decided in Birmingham to make these instruments in the Gas Department meter-shops. Accordingly, a modified and improved design of Jünkers calorimeter was evolved, which has given every satisfaction under actual testing conditions.

The arrangement of apparatus used in testing for calorific value, apart from the calorimeter itself, was discussed; the importance of a proper water supply of uniform temperature, the need for careful governing of the gas under test, and the necessity of using properly checked thermometers, being dealt with. A bench containing two complete sets of apparatus for testing for calorific value, as employed at Birmingham, was shown in illustration, and also the special method adopted for drawing fresh gas on to the apparatus before commencing to test, in which use is made of the vacuum in the inlet exhauster main to "pull over" the gas, through a Rotary meter fitted with outlet regulating cock and gauge.

The method of testing employed at Birmingham was given in outline; the importance of regulating the flow of both water and gas through the calorimeter, so that the number of heat units developed within the latter during each test shall be approximately the same for all gases, whatever the quality, being particularly emphasized. To allow of this, the author stated that the calorimeter burner was fitted with needle-valve injector, allowing a gas rate up to 15 c.ft. per hour at 7-10ths pressure, so that producer gas could easily be tested on the instrument while maintaining the same rise in temperature of the water passing through.

In a section devoted to "errors in testing," the author discussed the utility of the correction formula recommended by the Metropolitan Gas Referees in connection with the influence of variations in humidity of atmosphere and temperature of waste gases upon the results of tests. Data from actual tests, made under both average and low conditions of humidity, were given, showing that the correction advocated was very small (about 1 B.Th.U.), and not worth the extra labour involved, so far as the calorific value of gas for modern industrial purposes was concerned. In this connection, the method for testing at Paris, given in the "Journal" for Jan. 30 last [p. 202], was contrasted with the Gas Referees' method.

The effect on the results of tests due to measurement of volume of water heated, instead of weighing, and the effect due to non-correction of the volume of gas burned in the calorimeter for its pressure at the test meter, were considered; and it was shown that the net result of making all these various corrections was under 5 B.Th.U. The author remarked that their aim at Birmingham had been to reduce both apparatus and method of calculation to the simplest conditions, so that the test could be quickly and accurately made by a junior chemist, with a margin of error of 1 p.ct.

Some brief reference to recording calorimeters was made, and a short description of the Beasley Recorder (made by Messrs. Parkinson and W. & B. Cowan, Ltd.) was given. Mention followed of the fact that this instrument is constructed in two types—one being for use with coal or town gas, while the other is specially intended for low-grade gas, such as blue water gas, producer gas, or Mond gas. Both types indicated "net" heating value. The need of a recorder which would give the "total heat value" of gas was remarked upon; and it was hinted that very probably in the near future an instrument of this type would be placed on the market in this country, so that it would no longer be necessary, after the war, to go to Germany for this purpose, as it had been in the past.

There was no discussion on this paper.

SOME SOURCES OF BENZENE AND TOLUENE FOR HIGH EXPLOSIVES.

By T. F. E. Rhead, M.Sc., of Birmingham.

The author reviews the present state of our knowledge concerning the methods of production of benzene and toluene, observing,

however, that much valuable work has not yet been published, for national reasons. The value of these hydrocarbons for subsequent nitration depends on their ease of purification. Paraffins in toluene are objectionable, and processes yielding paraffinic toluene cannot compete commercially with those giving the pure product. The various sources are classified under four heads:

(1) Synthetic, catalytic, and electrical.
(2) Certain crude petroleums containing these hydrocarbons in the uncombined state.
(3) The destructive distillation of coal.
(4) The thermal decomposition or "cracking" of petroleum oils.

Four methods of production are mentioned under Group 1; but, as far as is known, they are all still in the experimental stage. Under Group 2, the author refers to the fact that it is now well known that considerable quantities of benzene and toluene can be obtained from the crude petroleums of certain districts; and this source proved of great value when the shortage of these bodies was serious. By far the most important source is that of coal distillation; and the author gives a *résumé* of our present information—still very incomplete—on the mode of formation of these hydrocarbons during this process. They are secondary products, formed from the primary thermal decomposition products by three main groups of reactions: (1) Condensation of olefines of 700° C. upwards; (2) the dehydrogenation of certain naphthenes at 500° C. upwards; and (3) the polymerization of acetylene at 700° C. Olefines, naphthenes, and acetylene occur among the primary products of coal distillation. Benzene is destroyed at the high temperatures 1000° to 1100° C., and owing to the practice of "high heats" in coal carbonization (in order to get the charges through in reasonable time), much of the benzene formed in a cooler zone is destroyed through contact with the hot walls of the retorts.

The author then deals with the factors governing carbonization in so far as they bear on benzene and toluene production. After referring to the washing of coke-oven and town gas for these substances, he mentions many of the various attempts to obtain an increased yield of them during carbonization. Oil-cracking is then treated; and the close relationship between this process and coal carbonization pointed out. The results of valuable American work are given, and carburetted water gas as a source is touched on, and some Birmingham results quoted.

In an appendix the author describes, with the aid of a diagram, a new washer, designed to wash 100 c.ft. of gas in four to five hours, in order to determine the crude benzol content of the gas. The apparatus is based on the bubbling counter-current principle, and is similar in construction to a fractionating still head. Prepared oil is used as a washing medium, and then steam distilled, and the distillate analyzed by Colman's method for benzene, toluene, &c. The apparatus is extremely convenient, and gives thorough washing of the gas, which requires to have an initial pressure of about 5 in. of water.

Discussion.

Dr. J. C. CAIN said he was not aware, as the author had stated, that the Germans claimed to have discovered benzene before Faraday. Also he disagreed with the author that synthetic phenol is much purer, and therefore more satisfactory, than phenol obtained from coal tar. Such a statement, in fact, was absolutely incorrect. There was no difference between the two phenols. The author suggested that benzene was purified by freezing. Had he used such a process? The work of Rollason, Stevenson, and others upon carbonizing coal with lime or limestone was interesting; but he did not think it was much value to mention it in this paper, because if the process were tried it would be found most unscientific and useless.

Mr. W. J. A. BUTTERFIELD, speaking with regard to carburetted water gas, said he published figures 20 or 25 years ago showing that it was quite possible to work carburetted water-gas plants so that the vapours in the gas consisted almost entirely of the aromatic hydrocarbons.

Dr. R. LESSING asked what was the percentage extract of oil from the gas after recovery, and what was the percentage recovery during the distillation process? It seemed that the amount of oil mentioned in the paper—viz., 4 litres per 100 c.ft.—was not far above that used in practice where high recovery was attempted. Therefore he was not quite sure whether the whole of the extractable hydrocarbons in the gas would be got out. At the same time, if the concentration of the benzolized oils was a low one, what was the efficiency of the steam distillation and recovery of benzene?

Mr. J. H. ALCOCK said that, as a pupil of the late Theophilus Redwood (father of Sir Boverton Redwood), he had been told that coal gas was originally carted from one house to another very much as cylinders of oxygen and carbon dioxide were to-day. These cylinders, when they were returned, contained a liquid which was sent to the Institution where Faraday was engaged. In a short time several gallons were collected; and he believed this was the true history of the origin of benzene. Unless the author had a first-class reference to support his statement, it should be cut out.

Prof. W. A. BONE said he was under the impression that the gas which the previous speaker mentioned was oil gas.

Mr. RHEAD, in reply, said he had taken the reference to the origin of benzene from a well-known text-book on coal tar and ammonia, and, similarly, the reference to phenols came from a recent work. Personally, he had no views on the matter. With regard to nitrating toluene, a recent American publication showed that up to 1 p.ct. of paraffin did not make much difference, but a large percentage made a very considerable difference. Paraffins from petroleum distillates were, he believed, being used in America; and although he was not quite clear, he understood that it made the process longer, and introduced another factor. If they could get pure toluene, however, it simplified the process to this extent. As to water gas being used for aromatics, many people knew this; but he did not believe the Government knew it when they started up, because they seemed to hesitate whether they could wash water gas when starting washing for toluol contents.

Mr. E. W. SMITH said that one of the first plants put up for extracting toluol was at Manchester, and there water gas was washed from the beginning.

Mr. RHEAD, speaking with regard to the percentage saturation in the washer described in an appendix to the paper, said that, working with ordinary coal gas giving 3 gallons of crude benzol per ton with 3 litres of oil, the saturation was about 3 p.ct. As to steam distillation, he had been using oil which distilled at 250° to 300° C., and by steam distilling to a very high degree, the amount left in was reduced almost to a negligible quantity.

RECENT DEVELOPMENTS IN THE INDUSTRIAL APPLICATION OF TOWN'S GAS.

By C. M. WALTER, of Birmingham.

In this paper, the author sketched recent developments in Birmingham in the application of gas to industrial purposes. While holding the opinion that the heating efficiency of the gas-furnace would undoubtedly be increased, he thought we were appreciably nearer the time when solid fuel for industrial purposes will be a thing of the past. As an instance, he mentioned the case of a gas-furnace installation for annealing glass. This consists of two 74 ft. long by 5 ft. 6 in. high furnaces, with a combustion chamber 20 ft. long. Gas was supplied at ordinary town pressure, and ordinary atmospheric burners were used; the secondary air being preheated. The result of tests showed that to maintain a temperature of 550° C. a gas consumption of 750 c. ft. per hour was necessary; and the overall heating efficiency was 30 p.ct. A similar direct-fired furnace gave an efficiency corresponding to about 8·5 p.ct. In the case of gas, the fuel costs amounted to 11·5d. per hour, as against 10·8d. with coal. Thus, although the cost of gas was only slightly in excess of that of coal, the efficiency of the gas-furnace was considerably higher; and making due allowance for the possibilities of improvement in the solid-fuel furnace, the advantages of gas must weigh greatly in its favour in many manufacturing processes.

The paper then described in general terms some specific applications in the Birmingham area.

METAL MELTING.

Phenomenal developments had taken place in this connection during the past twelve months, and at present many thousands of brass, gun-metal, and aluminium castings were being produced daily in melting furnaces heated by gas. At the same time, for the production of aluminium alloys gas-heated furnaces having a capacity of 600 lbs. were being employed. Not only has the speed of melting been considerably increased, but the fuel costs have been decreased, and the quality of the alloy improved. The relative efficiency of coal or coke-fired and gas-fired furnaces for this purpose had been shown to be approximately 3 to 15 respectively, as the result of experiments with 60/40 brass. A more recent use was for heating cast-iron; and in many parts of the country 60-lb. and 120-lb. pots were being used. Although fuel costs were higher than with solid fuel, yet the other advantages more than outweighed this one disadvantage. A hundredweight of metal could be melted for an expenditure of 700 c.ft. of 500 B.Th.U. gas, and from seven to nine heats per pot were obtainable.

ANNEALING.

For iron, steel, and brass stampings, turnings, &c., gas was rapidly replacing solid fuel, especially in cases where it was found advisable to split-up the annealing plant into small units. Repetitive work was handled much more easily, and temperature indicating apparatus was being used with great success. The result again was more expeditious work, greater uniformity, lower costs, temperatures more quickly obtained and easily controlled, and the number of units of plant in use could be adjusted in accordance with the amount of work in hand. The extent to which gas was replacing solid fuel in these particular applications could be gathered from the fact that in Birmingham during the last nine months, plant costing more than £12,000 had been installed in factories, consuming 250 million cubic feet of gas per annum.

CARBURIZING, HARDENING, AND TEMPERING, AND GENERAL HEAT TREATMENT OF METALS.

The same remarks applied here. Special furnaces for particular processes were being designed almost daily, with the result that working efficiencies were being continually improved. During the last six months, a considerable amount of investigation work had been carried out in the Industrial Research Laboratory of the Birmingham Gas Department on carburizing mild steel in a coal-gas atmosphere; and the process was being applied commercially for the casing of small parts of machine tools, gauges, &c. In this way, it had been found possible to reduce the minimum amount of distortion which took place on quenching.

PYROMETRY.

Special importance was attached to pyrometry by the author. This is a subject which was receiving more attention than it had in the past. Nevertheless, still further attention to it was necessary in the heat-treatment operations on repetition work to ensure

a satisfactory form of instrument being evolved. Although there were some excellent types of instrument available, the trouble appeared, in the author's view, to be largely due to the fact that the manufacturer was not always in the position to advise what type of instrument should be used for a particular purpose.

Discussion.

The PRESIDENT said the paper gave an interesting description of what the Birmingham Corporation had done, and in regard to which, in order to achieve success, they had spent a considerable amount of money, and had installed an extremely interesting and important plant. He believed the Birmingham Corporation plant which supplied gas to most of the furnaces referred to in the paper was unique of its kind in the kingdom.

Mr. DRUMMOND PATON asked what was the air pressure used in the furnaces for dealing with the ferrous metals. Was it high pressure?

Mr. E. P. TAUDEVIN said that, although the uses of gas for furnace purposes were without limit, yet the design of gas-furnaces was really in a very crude state. He did not think he had seen a well-designed gas-furnace yet. He had seen two or three annealing furnaces which gave some promise, and remembered seeing one of German origin which was designed to give the maximum efficiency with the least gas consumption in a given cubical space. Unfortunately, if anything heavy was dropped into the furnace, it broke the furnace floor. At the same time, when speaking of the enormous opportunities for using gas-furnaces, they must not lose sight of the fact that a gas-works had other products for use in furnace work. Coke could be gasified, and then there were the heavy tar oils, which would no doubt be produced in increasing quantities. Again, with the new plants for coke-oven gas coming into use, there would be a tremendous amount of coke on the market, and also heavy tar oils. These could be gasified; and they should take a wide and general view of the application of gaseous fuel to industrial purposes. At present, they were only on the fringe of the enormous field which was open to them.

Mr. E. W. SMITH said that if Mr. Taudevin wished to see an annealing muffle of first-class scientific design, he could see one erected by Sir Arthur Duckham, of the Woodall-Duckham Company. There were sixteen muffles, working in the South of England, 15 ft. by 5 ft. 6 in., all resting above the ground, heated with producer gas, so arranged that the bottom of the furnace dropped out in the form of a table. The strip for annealing was placed edgeways on the bottom. The furnace was rarely opened for more than forty seconds, while another table was put into position. With these muffles it was possible in two hours to get 3 tons of metal through, corresponding to 30 to 35 tons throughput per day. It was not possible to determine with the pyrometer a difference of more than 5° to 10° in temperature at any part of the muffle, although, of course, the temperature of the bottom was lower after it was put in. He believed that gas undertakings would have to face the competition of producer gas in such muffles. The flame was longer, and the heating effect was better. He had tried the effect of using water gas instead; but it was nothing like so good, either in the combustion space or in the muffles themselves. The free dilution of producer gas gave a longer and more effective flame for moderate temperatures and over big areas.

Mr. A. E. TUCKER said that in London 800 tons of brass was melted every week in gas-furnaces. Was the gas or the air compressed in the case of the furnaces mentioned by the author? He suggested that the pressure should be exerted on the gas and not on the air. This was the invariable practice with the furnaces with which he was associated; and it was a detail of great practical importance, because, by doing so, the action on the pots was reduced. These cost £4 to £5 each; and therefore it was important. Moreover, the heat was more easily controlled. This, again, was important, because the Government specification for copper allowed fairly wide limits. Unfortunately, they did not have scientific workmen to deal with—in fact, they were for the most part quite ignorant men, who did not appreciate the significance of the heat exceeding that which was sufficient to melt the metal. With some gas-fired furnaces, he had known something like 10 p.ct. of zinc to be simply distilled away through this cause. The furnaces he was speaking of were of the simplest kind. The jet conveying the compressed air went into the tangent, and there were half-a-dozen outlets all the way up. The whole of it was made of comparatively thin sheet iron, riveted up on a trunnion and worm gear. The whole was comparatively light, and the pots used were between 600 and 700 lbs.

Dr. FEILMANN mentioned that one firm in Coventry had a quarterly gas bill of £3000 in connection with gas-furnaces. He was glad the author had emphasized the need for pyrometric control with furnace work, because very often the value of the furnace was determined by the accuracy with which the temperature could be checked.

The PRESIDENT said the mistake made in depending on the average workman to use pyrometers was that the scale was not sufficiently open. Scientific men were used to having pyrometers with which very small differences were detected; but workmen were not used to thinking on these lines. If, however, the workman was given a fairly open scale, where the difference in figures represented something tangible, there was no difficulty. At any rate, this was the experience with his men, whom he had found no difficulty in getting to work within very close limits.

Mr. WALTER, in replying, said the air pressure when reducing iron was 2 lbs., the gas being at ordinary temperature. In many instances, however, it was found more satisfactory to use both gas and air under pressure for this purpose. The main advantage of this was that the variations in gas pressure which were bound to take place were to some extent eliminated. As to whether the gas or the air should be compressed, in Birmingham seventeen miles of high-pressure gas-mains were transmitting at a working pressure of 12 lbs. per square inch. Manufacturers on the routes of these mains could use the gas, and take in air by injection in the ordinary way. Quite a considerable number of these furnaces had been in use for five or six years; and where there was a difficulty in obtaining high-pressure gas in a works, compressors were installed for the purpose. There were several large installations of the latter type. One thing to be remembered with high-pressure gas was that the amount of gas which could pass into the furnace was decided by the size of the jet and the working pressure; and this was found to prevent the possibility of overheating the metal through using an excess of gas just prior to firing. With regard to the President's remarks on pyrometry, in connection with heat treatment it was of great value to employ instruments which had a set-up zero, so that a very open scale could be obtained.

PATENTS.

By Dr. A. REE.

The author, who is an aniline dye manufacturer of Manchester, in a short paper, urged that, rather than continue under present legislation, a return should be made to the patent law of this country before the 1907 Act was passed, for the reason that the compulsory working clauses of the Act were rendered nugatory as a consequence of the judgment of Mr. Justice (now Lord) Parker in the Hatchett case. Compulsory licences did not, in his opinion, meet the case, as the foreign patentee would of necessity hold back from the licensee much essential information which was necessary to work a process efficiently—it being common knowledge in the chemical industry that very few processes were worked merely in accordance with the patent specification. Whatever could be done in the way of compulsory licences, the patentee would always be years ahead of the licensee. The compulsory clauses of the 1907 Act worked thoroughly efficiently until the time of Lord Parker's judgment; but, unfortunately, on account of this they were only effectively in force for about fifteen months. To make them really effective, they must revert to the interpretation before that judgment. The argument in the judgment, that the applicant to the Courts for an order enforcing compulsory working must show proof that the patent was not being worked in this country, was practically an impossibility, as the patentee would naturally give no information; and, as the law stood at present, he could not be compelled to. If the onus of proof of adequate working was not to rest upon the patentee, then the applicant should have the same rights of "discovery" as in a Chancery suit, by means of interrogatories. He would like to see the Statute of Monopolies put into force in order to prevent Germans from taking out patents here and working them abroad, thus creating a protected market for them in this country at our expense—fostering German industries and damaging ours. It should not be that only part of the invention should be worked here. The difficulties of this were apparent at the outbreak of war, when it was found quite impossible to obtain certain intermediate substances which were essential to the manufacture of certain main products required. If the case he had put forward had been insisted upon years ago in regard to chemical patents, they should now have had an organic chemical industry in this country swallowing that of Germany. He disputed that the German position in certain matters was due to education. If the Chambers of Commerce had got what they had asked for years ago, there would have been an abundance of suitably trained English chemists to carry on. German interests in this country had been largely responsible for the present position; there being a threat of retaliation in Germany if we introduced compulsory working.

Discussion.

Mr. A. G. BLOXAM said that apparently Mr. Ree not only wanted to reform the Patent Law, but to get away from the prime principles of free trade; so that any discussion of this matter must become far more political than at first sight might appear to be the case. As to the threat of retaliation in Germany mentioned by Dr. Ree, within a year of the passing of the Patent Act of 1907, both Germany and Austria altered their laws as regards compulsory working, and made them precisely the same as those in the 1907 Act. In other words, German patents granted to foreigners were to be revoked if the patentees worked them mainly abroad. Thus there was retaliation, because previously the conditions had been easier for us.

Dr. REE said the system of compulsory working introduced in Germany after the 1907 Act was not really retaliation, because before that the German system was more severe than ours; so that the change made things, in a sense, more favourable to us.

Mr. J. W. HINCKLEY suggested that we had reached a stage in the chemical industry in regard to patents in which the whole system of patents had broken down. In chemistry, to patent a process was simply to tell everybody what was being done, and give the business away before it could be established. Therefore, the patentee required more protection from the State without so much expense. At present, the State obtained all the benefit. There were, nevertheless, a very considerable number of inventions which were not patented simply because the inventor realized he would be giving himself away if he did. He knew of recent instances in which inventions had been sold for very large sums, and they had not been patented. The inventors would probably have spent large sums in patenting their processes, and also their brains and energies in looking after their rights, instead of, as they had done, developing their businesses. So far as the chemical industry was concerned, some State action, other than the Patent Act, was essential in the future.

CO-OPERATIVE RESEARCH.

By H. W. ROWELL.

In this paper, entitled "Schemes for Co-Operative Research," the author called attention to the fact that, so far as he was aware, co-operative research is unknown in this country, whereas it is practised extensively in America. A large research organization could afford to buy better brains and plant, could risk more on unsuccessful work, and had more success and was less costly in

proportion to its results than a small laboratory. There were comparatively few works in this country, even in the distinct chemical industries, employing separate research staffs; fewer still which thoroughly equipped their staffs; and none which spent sums comparable with German or American firms of similar importance. The war had forced home upon us the fact that we are not so much individuals as a nation in trade and manufacture, and it seemed that the individual firms in many industries would have to formulate working agreements of various kinds if they were to meet American and similar world competition. This suggested the broadest type of scheme on the lines of the technical combination of about twenty firms of incandescent electric lamp manufacturers in the United States, which spent a large sum annually on co-operative research.

A group of manufacturers of (say) sulphuric acid or tar products would pool for their common good investigation into raw material, methods of manufacture, improved products, disposal of bye-products, outside competition, and so forth. A full-sized factory could by run in connection with the laboratory, as in the case of the American lamp manufacturers, to provide exact working data and efficiency methods and help pay the cost of research.

At the other end of the scale, something on the lines of the Mellon Institute in Pittsburg might be adopted. A large institution in charge of an experienced director and a small permanent staff of specialists was erected and endowed by subscription. It was fitted with a number of private chemical and physical laboratories, and was, or might be, fitted with experimental machinery of the type required on a small works scale. The manufacturer placed his problem before the director, who found him a University graduate with suitable qualifications to carry out the work at an agreed salary. It was then arranged to carry on the work for a maximum time; and the chemist had the sole use of one of the laboratories and certain experimental plant, the guidance of experts on the staff, the use of the library, and other general assistance for a definite sum. Or the institute might agree to use the permanent staff only and take part payment by results.

There was no doubt that the first scheme of co-operation throughout a trade was the most profitable to all concerned; but there seemed to be no probability of the British manufacturers combining in this wholesale way for many years to come. Something less ambitious, organized in such a way that it could be developed into the full scheme as progress demonstrated, seemed to meet the present state. The tar trade might be taken as the first example, for it seems to be faced with both a commercial and technical revolution after the war. Coke-ovens and large gas plants were partly refining their own products in competition with the tar distiller. Coke-oven and vertical retort tar was quite different from the old types, and in increasing supply, and crude benzols and ammonia were more fully recovered. Methods of distilling and fractionating were altering, and required alteration, and the products of distillation would have to be marketed in a different state of purity, and the values of tar products—never very stable—were likely to be altered considerably. The analytical tests accepted for sale purposes in the trade were sheer guesswork, and the chemists employed were not allowed to alter them. The manufacturer explained that the custom of the trade—that hoary British institution—could not be altered; yet the Ministry of Munitions recently altered the tests for benzene and toluene, and other good work had been done.

If the tar distillers had commercial agreements as to raw materials, sulphate of ammonia, and creosote, why not in standard tests and products and in research and development of the trade? The tar producers and distillers could subscribe (say, in proportion to their capital or turnover) to institute a central laboratory and experimental works; while control testing and efficiency of existing plant would remain a matter for the attention of the individual works. This laboratory could have two functions—one, an analytical department for devising specifications and standard methods of analysis and acting as a referee laboratory for the trade, the other a research department with experimental works and a staff of chemical engineers attached to it.

The central analytical laboratory idea offered no difficulty—the cost would be small, and the results of distinct value; but unless the trade was closely allied by commercial agreements, the question arose as to what work could be undertaken by a central research department. A phase of work of general importance in which business interests could not clash was in raising the demand for, and consequently the price of, tar products, and in meeting competition from other trades and nations. If a research department could make pitch equal to natural bitumen, tar oils into fuel, and lubricant equal to petroleum oils, or discover a use for creosote oil equal to the present demand for timber preservation—and these things are by no means impossible—it would cover its cost many times over. No single firm could provide properly sustained research facilities or be expected to stand the cost of such work, which is for the benefit of the trade as a whole.

The tar-works were the proper place in which to make dye-stuff intermediates, as it economized capital, material, transport, and labour.

Other matters of a non-competitive nature which might be taken up at once were the carriage of dangerous goods, better and cheaper packages, safety measures against fire, explosion, and industrial disease, and fuel economy. If an organization got as far as this, it would certainly develop into a full combination of technical interests. It would follow that the methods of distillation and the value and composition of the tar produced, and the possibilities in blast-furnace, producer-gas, and oil-gas tars were all matters for investigation of profit to producer and distiller.

The quantities and value of the coke, gas, and so-called bye-products could be greatly modified by alteration in the method of working as well as in the design of apparatus; and as coke-ovens, gas plants, and recovery plants are usually in charge of an engineer, the chemical aspect of the problem did not get full consideration. A coke-oven plant would call upon the research organization to inquire into the efficiency of all or part of its plant, or have experiments made on a more suitable type for its particular class of coal. The tar distiller could have his tar supplies tested out on a works' scale, and be advised of a better plan of working them to obtain a more profitable fractionation. There were great possibilities in this which could not be shown on a small-scale laboratory test. The distillers in general could have experiments made in washing and purification of the various products, and the numerous problems of fractionation, distillation, and filtration which trouble the works could be solved on practical lines for the mutual benefit of the subscribers.

It could be agreed that certain details would be private between a subscriber and the research staff, while the majority of the work could be detailed to those in the combination who required it. It would probably result that in time no works would consider a new type of plant offered by manufacturers until the research departments had reported on it.

Discussion.

Mr. E. W. SMITH, of the Birmingham Corporation Gas Department, took up the author's point that co-operative research is practically unknown in this country. A considerable amount of co-operative research was going on, of which the author should have been aware, in connection with the Birmingham brass industry. There was a well-equipped research metallurgical laboratory run by the Corporation, to which a very large proportion of the brass casters of the city went with their problems. The work that was being done was entirely co-operative, and fulfilled all the conditions laid down by the author. Surely the author should have known, too, that the gas industry had been carrying out a considerable amount of co-operative research for many years. The Institution of Gas Engineers had its Sub-Committees working in conjunction with University authorities, and chemists had been paid for years for working on technical research the results of which had been available to the whole of the gas industry. Therefore, he did not think the author's statements were justified.

Prof. W. A. BONE criticized in somewhat similar terms certain of the statements made in the paper as to the alleged backwardness of British manufacturers in the iron and steel industries.

Prof. C. A. KEANE also thought that the author had gone a little too far in saying so definitely what should and what should not be. There were many ways of arranging research work, and all should be considered and as many as possible tried. At the same time, industrial research fellowships were making great headway in the United States, particularly in Pittsburgh, and every encouragement should be given to them as one contribution towards industrial research. During 1916 no less than 80 men were directly engaged there in industrial research work on behalf of chemical firms by whom they were indirectly engaged *vid* the University. At the same time, we were not altogether without knowledge of such organizations in this country. Experiments were on trial in more than one institution on lines somewhat similar to the industrial fellowship system of Pittsburgh; and it was encouraging to know that manufacturers in this country were looking to this kind of co-operative research. He had even heard that one firm had written to Pittsburgh for information as to when such research could be carried out in this country! There was too much tendency to lay the blame for our condition of affairs on somebody else; but it was a point of view which must be put entirely on one side. There was no special door at which the blame could be laid. We were all to blame; and let us share the blame as fully as we could, by putting our respective houses in order. One way of improving the position would be to ask manufacturers to submit problems to the educational institutions. The terms would not be difficult to arrange so long as the governing bodies concerned or the local authorities would recognize that the men in charge of their institutions were respectable, honourable men, in whom confidence could be placed, and to whom also authority could be given. This was fundamental. As soon as educational authorities and governing bodies wanted to know everything that was going on, the whole system must fall to the ground. The men must be trusted; and the experience of the war had shown that academic chemists were capable of being trusted and doing work of considerable national value. One of the great difficulties in training chemists for industrial occupations was to keep in touch with the requirements of the industry itself. What he had suggested would be a means leading in this direction. It would also be a means of permitting the most brilliant of our younger chemists to obtain industrial positions, and so save them from the blind alley of University and technical college demonstratorships.

Mr. ROWELL, in his reply, said he had put as many points as possible in the paper upon which he could be attacked, as that was a good way of obtaining information; and he certainly had done this. He agreed with Prof. Keane that there were many ways of dealing with the question of research, and that the Universities must have some connection with industry. But Prof. Keane had, so to speak, given all the show away in his instance of a British firm writing to Pittsburgh for information on this matter. The fact was that nobody knew anything about it here; and the chemical trade was not the only "pebble on the beach." The attitude was well exemplified here by that of one of the largest and most successful motor tyre firms, who did not employ a chemist, and who asked why they should. Much the same thing applied in the textile trade, which had been the means of bringing the matter forcibly to his notice. He was glad to hear from Mr. Smith what was being done in Birmingham. He had understood that it had only to do with gas. Nevertheless, he knew that some smelters in Birmingham had not yet come into the organization which Mr. Smith had referred to.

GAS AS A LABOUR-SAVING AGENT.

That the generation of high-pressure steam in quantity for technical purposes is best accomplished by a boiler heated with solid fuel is admitted; but there are hundreds of purposes for which moist or low-pressure steam is required in small quantity. In such cases, the low cost, high efficiency, safety, simplicity, and ease of operation render the use of a gas-fired generator preferable, writes Mr. Gilbert C. Shadwell in the "American Gas Engineering Journal." They can be fitted with safety blow-off and low water alarm; and for continual use an automatic feed is advisable. Consequently, they have found much favour for purposes such as steaming hats, cloth, woollens, velvets, umbrellas, and pleated dress goods, for making feather boas, for curing tobacco, for laundry work, melting honey, steam carving tables, food warmers, &c. The boiler is preferably made of copper with brazed joints, and the outer case of galvanized iron. Burners are fitted capable of raising steam within a few minutes of starting cold. An arrangement for the supply of dry superheated steam can easily be added.

The same periodical contains an interesting description of an "all-gas" factory known as the Errington Mechanical Laboratory. Every article made in the factory must be hardened; and many have acquired a value of £4 or so when they reach the furnace, where a heat up to 2100° Fahr. is required, and a fluctuation of a few degrees either way may spoil the temper. That the proprietor, who has acquired an extensive reputation as a mechanical engineer, should prefer gas to other fuels, is a striking testimonial in its favour. He uses three gas-furnaces, 12 in. diameter, 6 in. by 8 in. opening, and 12 in. square opening respectively, and Bristol pattern pyrometers. During an extended period of service they have never failed; and he states that there can be no question about gas being by far the best fuel for his class of work. Power is supplied by three gas-engines.

Attention is also directed, in a communication from Mr. J. E. Bullard, to the utility of gas in connection with laundry work. He claims that the addition of a complete set of labour appliances to a laundry will enable one woman to do the work of five, which is a great consideration now that so many other outlets for female labour are in evidence. Women find that factory work with machinery is less exhausting, and the hours are shorter than the average day's wash. He urges gas salesmen not to stop at the placing of washing machines, drying closets, ironing or hot mangle arrangements, &c., but to follow up by undertaking the entire lay-out and fit-up of the home or small trade laundry to the best advantage, according to the space available. There should be no waste carrying things from one part of the room to another. Each process should follow in regular sequence. An automatic gas-heater provides an ample supply of hot water at a few minutes' notice. Cold and hot water service should be arranged, also direct connection for running off waste; so that there is no carrying water about. Sometimes the available space is limited, and much care is required to secure a lay-out to the best advantage—another reason why this important consideration should not be left to the consumer.

Industrial Canteens.

It is remarked by "Machinery," while drawing attention to the efficacy of a well-arranged canteen in reducing industrial fatigue to a minimum, that in controlled establishments and national factories alone 810,000 workers are daily provided with complete meals. With the improvements that have now been made in this direction, it is recognized that in the vast majority of cases the industrial canteens installed throughout the country are not intended as war-time measures, but are of a permanent nature. Along with two photographs, our contemporary gives an example of the type of arrangement referred to in a short description of a canteen recently fitted up at the works of Messrs. John Booth & Sons, at Hulton. The building includes a main dining-hall capable of accommodating 300 people to dinner at one sitting. Gas is the fuel used; and the kitchen equipment has all been provided by the Richmond Gas Stove and Meter Company, Ltd. It comprises a large roasting oven, double-oven range, stock-pot and vegetable or pudding steamer, an ample-sized circulator for providing hot-water for washing-up and general cleaning purposes, two small boilers for soups, vegetables, or meat, and a combination carving-table and hot closet, in which meals are placed just prior to the luncheon hour. Convincing proof of the efficiency of the equipment is furnished by the statement that the whole of the 300 workers are served within ten minutes of their first entering the building.

The British Thermal Unit.—Writing to "Engineering" as to the proposed use of the word "therm" [see last week's "JOURNAL," p. 106], "C.R.K." points out that it is nothing new, and "its use seems to have given way to 'B.Th.U.' Therm," he says, "is the term used throughout a treatise on 'Heat and the Steam-Engine,' by I. Warren, M.A., published in Dublin in 1895. On p. 54, it is said: '1 therm = heat required to raise 1 lb. of water through 1° C.—the English thermal unit.' '1 calorie = heat required to raise 1 kg. of water through 1° C.' '1 calorie = 2·2 therms.'"

PRODUCTION OF COKE.

EFFECT OF THE TEMPERATURE OF CARBONIZATION ON PHYSICAL PROPERTIES.

A recent paper before the French Academy of Sciences by MM. GEORGES CHARPY and MARCEL GODCHOT describes some results of a laboratory test which has been worked out by the authors for the purpose of providing a means of ascertaining on a small scale the temperature of carbonization which is best suited for improving the quality of coke from coals which do not come in the coking category. The authors' object has been the improvement of coke from such mediocre coals, and the extension of the series of coals which can be used for coking purposes.

As a criterion of the quality of the coke, the resistance to compression (expressed in kilos per sq. cm.) is adopted, and is measured by a small lever machine. The coal to be tested is powdered and carefully sieved (through a 120 sieve) so as to obtain all the grains of approximately the same size. It is then kept for several days in an atmosphere saturated with water at 18° to 20° C., and in this standard condition of moisture is packed in a small refractory tube and subjected to a pressure of 5 kilos per sq. cm. (71 lbs. per sq. in.). The ends of the tube are closed by heavy cast-iron discs, and the whole then heated in an electric furnace of such a size that the introduction of the coal does not materially affect its heating power. While this method cannot be applied to every coal without some modification, with those studied by the authors it yields small cylinders of coke of perfectly regular shape (12 mm. in diameter and 20 mm. in length ($\frac{1}{2}$ in. and $\frac{3}{5}$ in.), to which the compression test is easily applied, and which supply practically constant figures throughout a series of tests.

This method of testing has served to confirm the injurious effect upon coking of the oxidation of the coal (as studied notably by M. Boudouard) and of progressive heating of the coal. In using it to examine the effect of the temperature of carbonization upon the quality of the coke, the charged tube is introduced into the electric furnace, previously brought to the given temperature, and the heat continued for one hour. The results obtained in this way are given in the table in the case of three coals carbonized at 650°, 800°, and 1000° C. The effects of oxidation on these same coals has been the subject of previous investigations by the authors. [See "JOURNAL," May 1 last, p. 191.]

Each test was made six times under the same conditions; the figures show the degree of concordance which the method permits.

Resistance to Compression, in Kilos per Sq. Cm.

Temp. of Carbonization.	St. Eloy. Single Tests.	St. Eloy. Mean.	Ferrières. Single Tests.	Ferrières. Mean.	Noyant. Single Tests.	Noyant. Mean.
650° C. (1200° Fahr.)	20, 22, 19 / 17, 20, 21	19·85	18, 19, 21 / 17, 20, 19	19·0	99, 98, 94 / 100, 104, 105	100·0
800° C. (1440° Fahr.)	31, 29, 36 / 35, 34, 32	32·9	27, 30, 31 / 28, 34, 33	30·5	92, 98, 93 / 94, 90, 95	93·6
1000° C. (1800° Fahr.)	35, 36, 38 / 41, 40, 42	38·7	49, 44, 48 / 42, 43, 46	45·0	39, 33, 36 / 38, 35, 37	36·3

The most remarkable feature of the results is that the effect of temperature is different upon the different coals. While those of St. Éloy and Ferrières yield at a low temperature a coke which is practically useless, at 1000° the coke, though still of mediocre quality, is of use for certain purposes. On the other hand, the Noyant coal at 650° yields a good coke, while at 1000° C. its quality is almost below that from the two other coals. These differences are still more marked if, after heating to 650°, the temperature be gradually raised to 1000°. Under these conditions, the St. Éloy coke is not appreciably improved, while that from Noyant coal acquires a resistance of 130 kilos. per sq. cm.—*i.e.*, 1850 lbs. per sq. in.—corresponding with very good metallurgical coke. The authors are pursuing further work, but have published the present notes and results in the aim of emphasizing the importance, in the manufacture of coke, of determining the conditions of carbonization which are favourable to a given coal.

The Midland Section of the Coke-Oven Managers' Association were this month to have visited the bye-product coking plant of the New Monckton Collieries, Ltd. But owing to extensive alterations at the place, the fixture has been cancelled. A meeting of the section will be held at Sheffield next Saturday, when Mr. E. Kilburn Scott, Assoc.M.Inst.C.E., M.I.E.E., will read a paper entitled: "Manufacture of Ammonium Nitrate by Electric Power at Coke-Oven Plants."

A recently issued technological paper (No. 70) of the United States Bureau of Standards, Washington, is on the subject of the "Durability of Stucco and Plaster Construction." The paper presents a report of progress in an investigation undertaken by the Bureau five years ago in co-operation with manufacturers. Though there is in it a good deal of suggestive information, definite recommendations are deferred until further test results are known. Those interested may obtain a copy by addressing a request to the Bureau.

APPARATUS FOR REDUCING VOLUMES OF GASES TO STANDARD TEMPERATURE AND PRESSURE.

By A. V. C. FENBY, of the Whitgift School, Croydon.

[From the "Chemical News," July 6]

The apparatus to be described has been designed to facilitate the reduction of the volumes of gases, measured at known temperatures and pressures, to volumes at 0° C. and a pressure of 760 mm., and to effect a saving in the time usually spent on these calculations. A direct reading instrument for this purpose should be of considerable service in the laboratory.

If the volume of a gas, measured at $t°$ C. and under a pressure of P mm., is pVt, then the volume at 0°C. and under a pressure of 760 mm. is:

$$760V_0 = pVt \times \frac{273}{(273+t} \times \frac{P.}{760} .$$

The apparatus is designed to measure the factor:

$$\frac{273}{(273+t)} \times \frac{P}{760},$$

by which the volume pVt is to be multiplied to reduce it to volume at 0° C. and 760 mm. pressure; this factor being read off directly from the apparatus.

The apparatus can also be used to calculate the volumes of gases (*a*) when heated $t°$ C. at constant pressure, (*b*) when submitted to a change of pressure at constant temperature, or (*c*) when heated to temperature $t°$ C., and submitted to a pressure P mm. after measurement at 0° C. and 760 mm. pressure.

The apparatus shown in fig. 1 consists of a horizontal arm A B, to which is attached a vertical arm, C D, hinged to the slide, *a b* which moves along A B, and can be clamped in any position on it. When not in use, C D is shut-down along the upper side of A B. A third arm, E F, is fixed to A B, and turns about the end E. This arm can be clamped in any suitable position by the screw G, which moves along the slotted arm H. The outer portion of the arm, E F, is enlarged, and carries a transparent scale with a centre line, *f g*, ruled on it. This scale serves as a cursor; and the arm, E F, is called the "cursor-arm."

The arm, C D, is provided with two scales. That, V V, on the left is the "volume-factor" scale; and the scale, T T, on the right is the "temperature" scale. This is graduated in ° C. from 0° to 100°, and from 0° to − 273°, or in absolute temperatures from 0° to 373°. [The figures are not shown in the illustration.] The scale, V V, is marked 1·0 at the point where the line *f g* cuts it, when the line *f g* passes through temperature reading 0° C., or 273° absolute; and it is graduated to heat from 0 to 1·7 in hundredths of the unit volume, as shown.

The slide, *a b*, which moves along the arm, A B, is provided with a pressure scale engraved on it, showing differences of pressure of 10 mm., between 720 mm. and 800 mm. The centre line of the arm, C D, can be moved along this pressure scale by means of the screw, *e*, which moves the carrier, *c d*, to which C D is fixed. The arm A B is called the "pressure" arm, and the arm C D the "temperature" arm.

To use the apparatus the temperature arm is set with its centre or zero line over the reading 760 mm. on the pressure scale; and the slide, *a b*, is moved to the position indicated by the index *i*, on A B. The cursor is then set to the temperature 0° C., or 273° on the scale T T. The volume factor is 1·0, as shown in fig. 1.

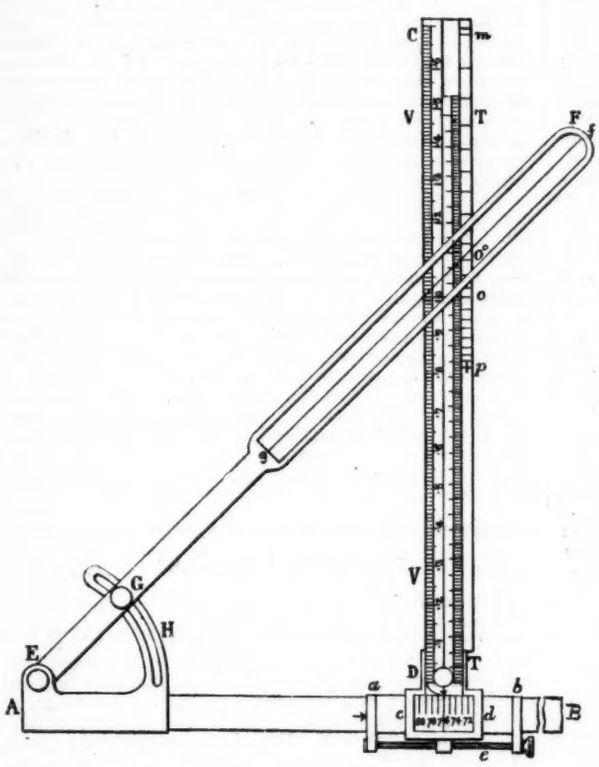


Fig. 1.

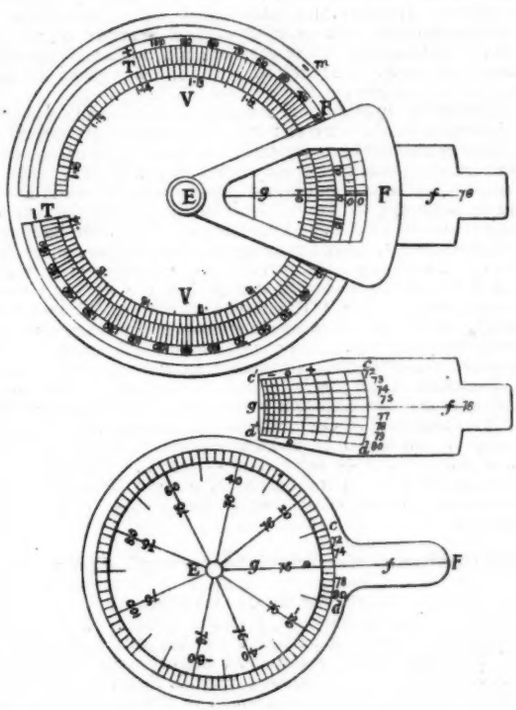


Fig. 3.

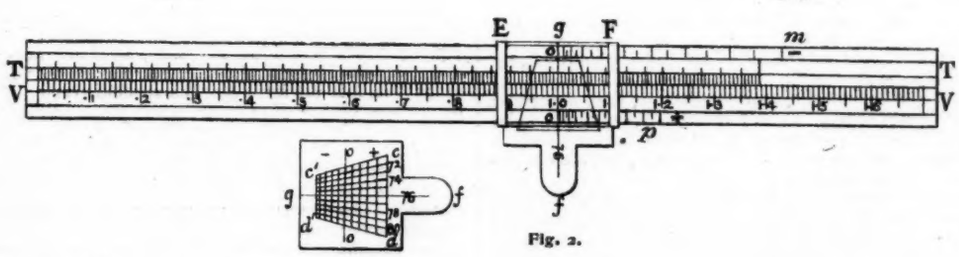


Fig. 2.

(*a*) If the cursor is moved $t°$ above 0° C. or 273° absolute, the pressure being unchanged, the cursor will give the "volume-factor" for temperature $t°$ C., and pressure 760 mm.

(*b*) If the temperature is kept at 0° C. or 273° absolute, and the arm, C D, is moved by the screw *e* to a pressure P mm., the cursor reading on the scale V V gives the volume-factor at 0° C. to change to pressure P mm. from 760 mm.

(*c*) If the volume-factor for a change from 0° to $t°$ C., and from pressure 760 mm. to pressure P mm. is required, the cursor is moved $t°$ above 0° C. (or 273°), and the arm C D is then set with its centre line at the new pressure P mm. The cursor reading on the scale, V V, now gives the required volume-factor. Suppose it is required to find the volume-factor for a change from 0° to 15° C., and from pressure 760 mm. to 750 mm. The cursor is set to the

reading 15° C. (or 288°), and the volume-factor reading is 1·056 (factor for temperature change only at pressure 760 mm.). The arm, C D, is now set to the new pressure 750 mm.; and the volume-factor becomes 1·070.

(*d*) The reduction of the volume of a gas measured at temperature *t*° C., and under a pressure of P mm. to its volume at 0°C., and pressure of 760 mm., is effected as follows: The scales are first set as shown in fig. 1 and explained above. The cursor is moved to the temperature (273° + *t*°), and the arm, E F, clamped in position. The arm C D is now moved along A B until the volume-factor 1·0 is under the cursor, and the slide *a b* is clamped. The cursor is moved to the reading +*t*°, on the scale *o p*, shown to the right of T T. This scale, *o p*, is called the "reduction temperature" scale, and it is necessary because the changes of volume are being made on the volume at *t*° and not on the volume at 0° C. A similar scale, *o m*, is shown on the left for changes made at temperatures below 0° C. These "reduction temperature" scales are marked respectively + and −. In the illustration the graduations are only shown for every 10° and are not numbered. When the cursor has been set to *t*° on the "reduction temperature" scale, the reading on V V is the volume-factor to reduce the volume to 0° C. at pressure P mm. The pressure is now changed to 760 mm. by moving C D along the pressure scale; and the volume factor required is read off.

An example will make this clear. A volume of Vcc. of gas, measured at 30° C. and under a pressure of 720 mm., is to be reduced to volume at 0° C. and 760 mm. The apparatus being set as shown in fig. 1, the cursor is set to the temperature reading 273° + 30° = 303°; and the arm C D is moved inwards until the volume factor is 1·0. Then this arm E F is moved down to 30° on the + "reduction temperature" scale, *o p*. The volume-factor is now 0·900 (for volume at 0° C. and pressure of 720 mm.). The arm C D is next set at pressure 760 mm., and the volume-factor is now 0·853. Therefore V cc. × 0·853 gives the volume at 0° C. and 760 mm.

By means of an additional arm between C D and E, and parallel to C D, graduated from 0 to 100, the apparatus can be used when calculating percentage compositions and results of combustion experiments. This arm is not shown in fig. 1. The extra arm, in conjunction with an additional scale along the arm A B, can be used to find "weight-factors," by which the weights of volumes of gases, measured at *t*° C. and pressure of P mm., can be found by multiplying the measured volumes by the "weight-factors."

In figs. 2 and 3 modified forms of the apparatus are given. In fig. 2, the apparatus is shown arranged on the slide-rule pattern. The temperature scale, T T, and the factor scale, V V, are arranged side by side, but one of them is movable parallel to the other, preferably the scale V V. The cursor carrier, E F, moves along the scales, as in a slide rule. The cursor, *c d*, *c' d'*, is shown separately for clearness. Here *f g* is the 760 m.m. pressure line, and the other pressure lines are slightly divergent, and are crossed by the zero temperature line, O O. Other temperature lines are drawn parallel to the line O O, and correspond to temperature intervals of 20° between + 100° C. and − 100° C. The scale *cd*, *c' d'* moves horizontally in the carrier E F; and thus any required temperature line can be set over the factor scale, V V. The "reduction temperature" scales, marked + and −, are placed on opposite sides of the apparatus.

Fig. 3 shows a circular form of the apparatus. The factor scale, V V, is inside the temperature scale, T T; but the reverse arrangement may be adopted here. One of the scales is movable (preferably the outer one), which is usually T T. The "temperature reduction" scales are marked on the same scale as that on which the temperatures are marked, and move with the scale T T if this is movable. The cursor-carrier, E F, revolves round the centre E, and the cursor scale, which is similar to that of fig. 2, moves horizontally in a slide in the carrier, E F, which can be clamped in position by the screw E. The circular cursor, shown below fig. 3, may replace the sliding cursor described above. The pressure scale, *c d*, from 720 to 800 mm. is marked in separate segments for intervals of temperature of 20° C. between 0° C. and +100° C., and 0° C. and − 60° C.

The method of using these forms is similar to that described above for the original form. When a change of pressure is to be made at a temperature *t*°, the cursor is set with the temperature line *t*° along the edge of the scale, V V, before the pressure change is made.

In the apparatus as described the temperature range extends from 0° absolute temperature to 373° absolute; but for most purposes a more limited range would be sufficient. The range of the apparatus, both as regards temperature and pressure, may be easily extended much beyond the above limits without enlarging the apparatus.

SHUT-OFF VALVES ON GAS SERVICES.

Along with the announcement of the appointment of a Committee on Automatic Gas Shut-Offs, there appears in the American "Gas Institute News" some discussion of the matter which contains points that may be usefully noted. The question first arose out of an inquiry as to the attitude of the gas industry in regard to the installation of gas shut-offs for services, put forward by Mr. W. H. Merrill, the President of the Underwriters' Laboratories at Chicago.

In response to his inquiry, Mr. Merrill was informed that gas companies are now, as they have always been, opposed to the use of any automatic shut-off for gas services, or of any kind of hand shut-off set in the wall of a building—it being thought that the ordinary service cock by the curb, and the cock located at the inlet of the meter, constitute the safest and most practicable form of shut-off that can be devised. The curb cock is not even regarded as a necessity for ordinary dwellings; the statement just made having reference to business and other buildings having gas-services of (say) 2 in. and over in size. When, it was added, it is borne in mind that only a very small percentage of all fires start in the immediate proximity of gas-meters, and that unless they do so the presence of the gas supply is not a menace, it is evident that the gas supply is not a risk. Moreover, even if a fire does start in the proximity of a meter, it must be assumed that there is a combination of a combustible floor overhead, of a fire so small that it would not independently set fire to the floor, and of the combustible overhead floor set so low as to be reached by the gas-flame, in order to admit a risk resulting from the presence of the gas supply. If the extremely improbable contingency is assumed, that a fire should start by the lighting of the gas through a leak in the meter or piping, even then the risk is slight. In Philadelphia, during the last twenty years, the number of gas-meters has increased from 150,000 to over 350,000; and the records show that there has never been a case in which the gas burning from the pipe which supplied the meter was a factor in the extent of a fire. There has also in this period been no fire in which the curb-cock, or a dig-up to cut off the pipe, was so slow as to add anything to the loss. The statement is a safe one that very few fires are caused by gas; and none of these would have been prevented or extinguished by an automatic cut-off, or by a hand shut-off at any point. The legal enforcement of the installation of more or less expensive automatic shut-offs on the gas-pipes would be an unwarrantable tax on the gas consumer and a handicap to the gas industry. After investigating the question in 1915, the Massachusetts Gas and Electric Light Commissioners reported that no legislation was necessary.

These arguments led to a still further communication from Mr. Merrill, in which he referred to a fire at which several firemen were alleged to have been injured in attempting to shut off the gas in a burning building. The answer to this was that the facts of the case showed that, if the firemen had let the gas-flames alone, and had devoted their energies to extinguishing the other part of the fire, in the meantime protecting the ceiling above the gas-flames by keeping it wet, they would have had little difficulty in turning off the gas without any risk of injury. "Don't smother-out the gas by a stream of water," is sound advice. Frequently during, or immediately after, a fire there is need of dependable lights, by means of which firemen or others may see their way about; and various forms of shut-offs projecting through the walls of buildings are only a menace, since their operation by irresponsible or excited persons might extinguish the lights when most they were needed.

Specification for Portland Cement.

A United States Government specification for portland cement is contained in a circular of the Department of Commerce of the Bureau of Standards at Washington, a copy of which is just to hand. This specification is the result of several years' work of a joint conference representing the United States Government, the American Society of Civil Engineers, and the American Society for Testing Materials; and it was to become effective on Jan. 1 last. It replaces a specification which was adopted early in 1912, and is itself recognized as not a final one, but subject to revision from time to time as occasion requires and as improvement is made in the product, in the methods of testing, and in technical knowledge of the material. With regard to the chemical properties, the following limits are not to be exceeded: Loss on ignition, 4 p.ct.; insoluble residue, 0·85 p.ct.; sulphuric anhydride, 2 p.ct.; and magnesia, 5 p.ct. Among the rules regulating the physical properties, it is set forth that the specific gravity of cement shall be not less than 3·10 (3·07 for white portland cement). Various tests are fully described and illustrated. Comparing the new specification with the one which it supersedes, certain essential requirements—such as strength, fineness, and setting properties—have been increased; while some unessential matters have been omitted. The Committee point out that the specification cannot be considered entirely satisfactory, as there is no test which furnishes specific information as to the relative value in concrete of the products of different mills. Another thing is that the methods of testing that have so far been devised are not as accurate as they should be.

Beehive coke production last year in the United States was, according to "Iron Age" [New York], the largest ever recorded. Official figures of the U.S. Geological Survey place the output at 35,464,224 tons, valued at $95,468,127. This is an increase of 7,955,969 tons, or 29 p.ct., over that of 1915, and larger by $38,522,584, or nearly 68 p.ct., in value. The average value of the coal used in 1916 was $1·26 per ton—an increase of 21 c. over 1915; and the average value of the coke last year was $2·69—an increase of 62 c. There were 65,605 active beehive ovens in 1916, as against 48,985 in 1915—an increase of 16,620. No new ovens were built.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Sliding-Scale Question.

SIR,—It is to be hoped that this important subject will not become entangled with extraneous points.

Under public ownership, gas profit is distributed by the local authority crediting its ratepayers in proportion to rateable value; but the measure of such profit is in no way contingent upon a sliding measure of price charged. On the other hand, private ownership distributes its divisible profit in proportion to nominal share capital, but always with reservation as to price charged.

Thus of the two categories mentioned, the divisible profit in the second either:

(*a*) Terminates abruptly on the price reaching a given point; or
(*b*) Tails-off earlier.

Consequently, under private ownership we have two distinct classes of capital, which for convenience we will call "A" and "B."

Apart from the general merits of the whole question as affecting "A" and "B" respectively, another class of investor, which we will call "C," is involved. "C" deliberately placed his money under (*a*) conditions, knowing that, if the worst happened, the whole income from the investment would be temporarily arrested. He was under no illusion at all about it; but he now finds that, by a subsequent Act of Parliament, his investment is governed, not by (*a*) conditions, but by (*b*) conditions, and upon the change his wishes were not consulted. His money was and is employed for public advantage, and may be the means of producing gas at something like only half the selling cost of what he believed to be the penal limit under (*a*). It is more than probable that the penal limit in his case was the factor deciding the investment.

In "C's" case, the change from (*a*) to (*b*) was arbitrary, and particular hardship exists. He may be a professional man already suffering war's injustice, and therefore doubly hit; or it may be the case of a lady incapable of earning, and unable to realize the little capital which kept body and soul together in pre-war days. Whatever, however, may be the actual circumstances, the investment, as you aptly observe, was looked upon as secure.

The eyes of the world are directed towards an international struggle for the assertion of right over injustice, for ideals which affect good faith. The same principle lies right here if the Board of Trade can be induced not to overlook it. Lord Moulton's opinion is that

> Without the direct aid of the gas industry . . . it would have been perfectly impossible for this country to have waged the campaign of the last three years, or even for any but a trifling time resist the overwhelming floods of enemies that were poured upon it.

Is this the opinion of the Government? "C's" capital has been used in pursuit of high national ideals, and "C" in asking for bread does not expect a stone.

For ourselves, we are custodians of capital and revenue in a particular industry where profit is regulated by Statute; and we must see that hardship is not inflicted upon those whose confidence we hold. Whatever may now be said indiscriminately of the sliding-scale, it is after all proper in principle, and in the future we may see co-ordination of this principle in all gas undertakings whether under public or private ownership.

July 19, 1917. OIKONOMIA.

REGISTER OF PATENTS.

Gas-Turbines.—No. 106,931.

KUHL, P. C., of Landusky, Montana, U.S.A.

No. 14,512; Oct. 12, 1916.

The object of this invention is to provide a turbine wherein the rotating element is actuated by the reaction of water and gas when leaving the turbine wheel. A further object is to provide a turbine "which will be simple in construction, efficient in use, and which can be manufactured at a comparatively small cost."

With these and other objects in view, the turbine consists of a combination of a frame with a shaft fixedly mounted on it; while a bell-shaped member encircles the shaft and has its minor end supported thereon. A plurality of blades is carried by the member and spaced from the shaft, which is provided with a passage communicating at one end with, and adapted to convey water into, the interior of the member. Means are provided for supplying an explosive mixture into the interior and for intermittently exploding the mixture so as to force the water and the resulting gases through the blades and out of them, whereby the water and gases will react upon the blades and so rotate the bell-shaped member.

Charging Apparatus for Gas-Producers. No. 106,977.

SAHLIN, A., of Kingsway, W.C.

No. 3988; March 19, 1917.

This invention relates to gas-producers charging apparatus of the type in which a rotating coal distributor nozzle or spout shape is adapted to feed and scatter the coal uniformly over the entire surface of the fuel bed in a producer like that described in patent No. 16,263 of 1903. The distributor is preferably equipped with the adjustable extension referred to in patent No. 16,125 of 1916, and is combined with a rotating feed drum or equivalent mechanism—the two co-acting in such a manner that each intermittent charge dropped from the drum through the nozzle will be deposited by and from the nozzle of the distributor around the bed of fuel at regular intervals, and at a certain constant radial angle from the previous charge, no matter how fast or how slowly the feed drum is made to revolve. The constant angle is so chosen that no multiple of this angle will be divisible by 360°. By so doing no two charges can be deposited on the same radial line on the bed of fuel, except at very long intervals.

Gas Lighting Torch.—No. 107,084.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 9221; June 30, 1916. No. 18,659, Dec. 30, 1916.

This combined invention may be regarded as an improvement on that described in patent No. 24,394 of 1912.

The improved construction comprises (in combination) a torch tube provided with a burner, a collapsible gas-container connectable to the torch tube, a diaphragm governor device serving to compensate for the fall of pressure during the discharge of the container (thus permitting a flow of gas from the container to the burner to feed a pilot flame), and a valve operable manually, directly or indirectly, to permit the passage of an augmented or supplemental gas supply for producing a flash at the burner.

Gas Ovens and Cookers.—No. 107,135.

THOMPSON, H., of Gainsborough.

No. 13,845; Sept. 29, 1916.

In order to reduce the cost of manufacture, and also to secure "greater economy of gas" and give "better and quicker results," the patentee suggests that the framework or shell of his stove should be constructed of wood, lined with asbestos or other non-combustible material, with an inner lining of sheet metal, so as to exclude all cold air from entering the oven or cooker during cooking operations. For heating he employs, for preference, a bunsen burner, the only opening for air being outside the oven. In the top of the oven a hole is made, over which a pan or other utensil for boiling purposes may be placed during cooking operations. The oven may contain one or more grids or shelves. If the latter are used, double sheets of metal are provided, with the edges turned over so as to connect the sheets and yet allow a space for air between.

Continuous Distillation of Tar.—No. 107,168.

KILBURN, B. E. D.; a communication from SULZER FRÈRES, SOCIÉTÉ ANONYME, of Winterthur, Switzerland.

No. 77; Jan. 2, 1917.

This invention relates to the continuous distillation of tar in two or more drums heated from the outside—the tar to be distilled passing through the drums in succession, while the heating gases are guided in the opposite direction along the drums. The arrangement is such that the heating gases are deflected to an extent capable of regulation, from the hottest drum in which distillation is completed to a colder drum. It has been proposed in similar apparatus to employ two stills, each with its own furnace, and to connect the furnace flues by a passage controlled by dampers; so that the gases from either furnace, after passing round the still belonging to that furnace, can be directed to, and flow round, the other still before passing out to the air. In the construction according to this invention, however, the two distilling drums are set in the same block of masonry. The tar is admitted continuously through the coils of a preliminary heater into a drum, where the light oil and the ammonia water are evaporated and conveyed to condensing apparatus. The tar, deprived of its light oil and ammonia water, then flows into the second drum, in which the distillation is completed. This is more strongly heated, and situated at a lower level than the other drum. The pipe conveying the vapours from the second drum leads to another condensing apparatus; while the remaining pitch escapes continuously through a pipe close to the part of the drum which is most strongly heated.

Gas-Fired Furnaces.—No. 107,263.

DAVIS, H. N., and TWIGG, W. R., of Luton.

No. 9543; July 6, 1916.

This invention relates to gas-fired furnaces for heating steel billets or ingots, crucibles, or the like.

The furnace comprises a reinforced fire-brick structure with a curved roof in the form of a half arch, so that one of the longitudinal side walls is higher than the other. The ends are closed by sliding counter-weighted doors. An inner floor (if desired, raised appreciably above the ground level) is built into the furnace independently of the main arch, so as to enable it to be readily renewed when necessary without interfering with any of the other parts. The floor is distanced from the main side walls of the furnace on the burner side by a plurality of vertical brick division-pieces spaced apart to provide a plurality of vertical flues leading into a main outlet flue or tunnel arch formed longitudinally under the floor. Above the flue the floor structure is tunnelled transversely, so as to form an upper supporting floor proper, which is raised from the body portion of the floor structure so as to allow the heated products of combustion to pass both over and under the floor proper before passing down the vertical flues to the outlet tunnel.

The gaseous mixture is sprayed into the furnace through openings near the top of the higher side, so that the products of combustion pass along under the half-arch of the furnace over the articles standing on the inner raised floor, and back between them above the floor and underneath the floor to the main outlet flue underneath. The half arch thus not only serves to deflect the flames down towards the articles to be heated, but also acts in a similar manner to the arch in a reverberatory furnace.

To heat the air to feed the burners an air intake pipe is arranged

with the main outlet flue, and branches lead out from it at suitable points in its length to the separate burners arranged along the side of the furnace—"thus ensuring an ample supply of heated air and making use of the heat of the escaping waste gases."

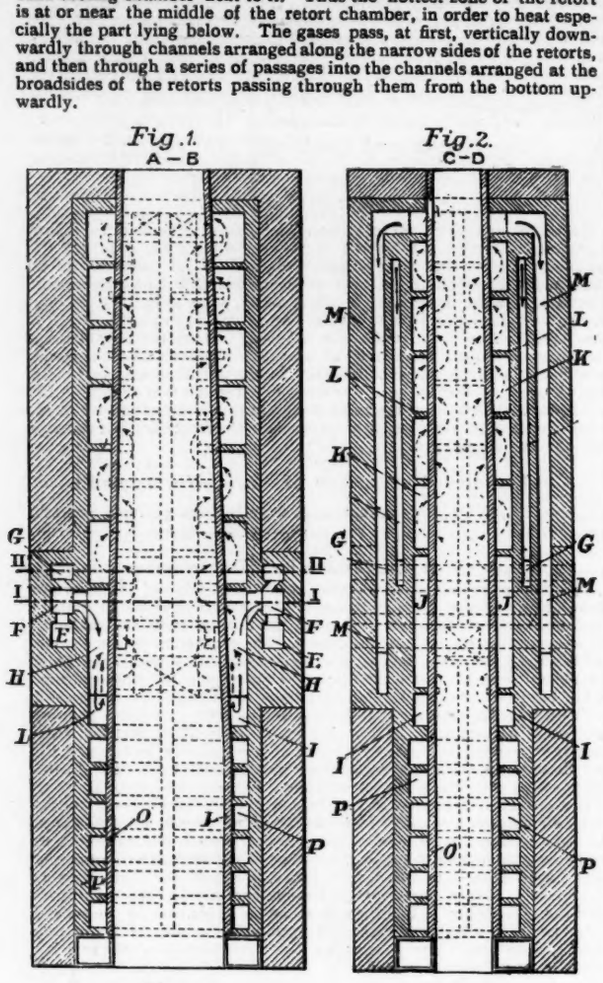
Heating Vertical Retorts.—No. 107,308.

STRASSMANN, P. G., of Crefeld-Linn a/Rhein, Germany.

No. 13,096; Sept. 15, 1916.

This invention relates to the production of illuminating gas in a vertical continuous working retort.

The distilling chamber is gradually heated parallel to the travelling fuel; so that after-distillation (after the passage of the hottest zone) is avoided, and the decomposition cannot occur. To this end the retort is divided up into three parts: (1) The fore-distilling chamber, which is only slightly heated; (2) the distilling chamber proper; and (3) the coke-cooling chamber next to it. Thus the hottest zone of the retort is at or near the middle of the retort chamber, in order to heat especially the part lying below. The gases pass, at first, vertically downwardly through channels arranged along the narrow sides of the retorts, and then through a series of passages into the channels arranged at the broadsides of the retorts passing through them from the bottom upwardly.



Strassmann's Vertical-Retort Heating Arrangement.

This part of the retort is exposed to the highest temperature, and forms the distilling chamber proper. Having passed the channels at the broad sides the heating gases enter the "fore-distilling chamber," through which they pass from the bottom upwardly along all sides of the retort. As the temperatures of the gases decrease with the distance they travel, a decrease will also consequently occur as they pass towards the feed-opening; so that the gas produced in the distilling chamber must come in contact with ever-cooler zones, thereby avoiding decomposition. On the other hand, the fuel passing through the retort meets with ever-hotter zones, thus causing progressive distillation until the gas has been completely expelled.

The part of the retort not exposed to the heat has a prolongation cooled by air or water; and the fuel issuing from the distilling chamber is cooled during its passage through (say) the water-cooled portion of the retort, and reaches the emptying device in a lukewarm state.

Finally, the patentee claims that the method and the retort have the advantage that the channels for supplying fresh air for combustion purposes are placed between the main fire gas channel and the main outlet channel in such a way that the air is preheated by means of both the heating gases sweeping the retort and the products of combustion leaving the furnace chamber, "whereby the recuperator required in other constructions, in this invention becomes superfluous."

Figs. 1 and 2 are longitudinal sections on the lines A—B (fig. 3) and C—D (fig. 4) respectively; figs. 3 and 4 are horizontal sections on the lines marked I.—I. II.—II. (fig. 1).

The channel E receives the carbonic oxide employed for heating purposes from a generator (not shown), and delivers it through an intermediate channel, from which it enters the channel F, which also receives the preheated combustion air from the channel G. The burner nozzles extend from the channel F so as to enable them to discharge the gases into channels H which descend along the narrow sides of the retort and through a series of horizontal passages I connected with vertical channels J on the broad sides of the retort. The channels are connected with the furnace chamber K, placed above the nozzles and divided-up into four segments surrounding the retorts. The chamber is provided with displaced walls L for compelling the gases to pass the chamber in a zig-zag direction. The products of combustion leave the furnace chamber through a horizontal channel below the furnace cover, whence they pass to the main outlet channels M, arranged vertically in the furnace wall, and are carried off below the burner nozzles.

The combustion air travels through vertically rising channels N (near the furnace chamber and the main outlet channel) and through vertical channels arranged between. Thence it enters the carbonic oxide channel F. Thus "a good preheating of the combustion air is obtained, so that special recuperators can be dispensed with."

The heated part of the retort is provided with an unheated prolongation O and with an air or water cooler P. The fuel here is cooled to the required temperature.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for July 18.]

Nos. 9858—10,239.

BEST, C. E.—"Apparatus for distillation of carbonaceous materials." No. 9904.

GIBBONS BROS.—"Feeding goods into, and removing goods from, annealing, &c., furnaces." No. 9924.

HARGER, J.—"Utilization and combustion of fuel." No. 9942.

HELPS, G.—See Harger. No. 9942.

HELPS, G.—"Manufacture and treatment of coal gas." No. 10,224.

HORSTMANN, S. A.—"Globe or shade for lighting purposes." No. 9862.

INMAN, C. R.—"Gas-heated furnaces for metals, &c." No. 10,064.

IONIDES, A. C.—"Furnaces." No. 9893.

MARLE, M. VAN.—See Gibbons. No. 9924.

MOHN, T.—"Gas-engine-driven air-compressors." No. 9957.

MURRAY, T. E.—"Manufacture of flanged tubes." No. 10,159.

NATIONAL GAS-ENGINE COMPANY.—See Mohn. No. 9957.

PERRY & CO.—"Adaptation of twin-generator gas plants for manufacture of water gas containing varying proportions of the component gases." No. 10,059.

SMITH, H. E.—See Perry. No. 10,059.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

"Jena" Glass.

General CROFT asked the First Commissioner of Works whether, as a result of research and experimental work which had been carried on by glass manufacturers, a glass had now been produced of as good quality as Jena glass; and, if so, whether he would give an undertaking that no more orders would be given by the Government to Messrs. Falk, Stadelmann, and Co.—a firm of German origin.

Colonel GIBBS, in reply, said special fire-resisting glass could now be made in this country; but as the firms who had facilities for its manufacture were engaged on more important work for War Departments, it was not practicable to place orders with them for this glass in chimney form. In the circumstances, effect could not be given to the suggestion in the last part of the question without harm to the public service.

General CROFT asked if the Department had given any intimation that it would do its best to avoid these contracts in future.

Colonel GIBBS said he would inform the Department of what General Croft had said.

Montrose Gaslight Company.—The annual meeting was held last Wednesday, with Mr. Muirden, the Chairman of the Directors, presiding. It was recommended that income-tax be deducted this year before the payment of a dividend, which was agreed to. Thereafter a dividend of £2 10s. per share, less income-tax, was declared, as against £2 12s. 6d., free of tax, last year. The gas manufactured was 47,995,000 c.ft., which, as against the previous year, showed a decrease of 1,061,000 c.ft. The relative decrease in the gas sold was only 306,000 c.ft., which meant a reduction of 2 p.ct. on the gas unaccounted for. The retiring Directors were unanimously re-appointed, as also were the officials—Mr. James Mitchell, the Engineer and Manager, and Mr. J. S. Officer, the Secretary.

LEGAL INTELLIGENCE.

PREFERENTIAL CHARGES FOR ELECTRICITY.

A COMPLAINT BY THE GAS LIGHT AND COKE COMPANY.

Attorney-General v. Mayor and Corporation of Hackney.

(*Before Mr. Justice* ASTBURY, *in the Chancery Division.*)

In this case the plaintiff, suing at the instance of the Gas Light and Coke Company, complained that certain differentiation charges made by the defendants in the supply of electric energy were in breach of the Electric Lighting Act of 1882, and consequential relief and an injunction were sought.

Mr. FRANK RUSSELL, K.C., Mr. COLEFAX, K.C., and Mr. PERCY WHEELER (instructed by Messrs. Monier-Williams, Robinson, and Milroy) appeared for the plaintiffs. Mr. A. J. WALTER, K.C., and Mr. G. F. SPENCE (instructed by Mr. Harold George Downer) represented the defendants.

TUESDAY, JULY 17.

Mr. RUSSELL, in opening, said the relators were a Company who supplied gas for lighting and power within a certain district, and the defendants were the Borough Council of Hackney, who supplied electrical energy for lighting and power within an area which was within the relators' district; and they did so under the provisions of the Hackney Electric Lighting Order, 1893. Sections 27, 28, and 29 related to the maximum price to be charged. Subject to the provisions of the Order and the principal Act, and to the right of the consumers to be charged according to the above method, the undertakers might make arrangements as to charge. By the Act of 1882, authorities were authorized to supply electricity; and "public" purposes and "private" purposes were described. It was in respect of sections 19 and 20 that plaintiffs complained of a breach. Section 19 provided that "where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the Licence, Order, or Special Act authorizing such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled, under similar circumstances, to a corresponding supply." Section 20 enacted that:

> "The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person; but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by, or in pursuance of, the Licence, Order, or Special Act authorizing them to supply electricity."

The Borough Council were the successors in title of the Board of Works of the Hackney District. The scale of prices in respect of which plaintiffs were suing was a scale published in July, 1914: Alternative No. 1.—(*a*) For lighting for any kind of electrical energy used each quarter not exceeding the equivalent of one hour's supply per day at the maximum demand 6d. per unit. (*b*) For any further quantity of electrical energy used each quarter, 1d. per unit. Alternative No. 2.—For any quantity of electrical energy used each quarter 3½d. per unit. For Power: Alternative No. 1.—A fixed charge of £1 per quarter per kilowatt of maximum power demanded, and charge for electrical energy used of ½d. per unit. Consumers paying under this scale are allowed to use 20 p.ct. of the energy consumed for lighting. Alternative No. 3.—For any quantity of electrical energy used each quarter, 1½d. per unit. The effect of this was that persons who consumed electrical energy for light only were charged more for their light than power consumers who also used the energy for light; or, to put it in another way, consumers of energy for power were supplied with energy for light at a lower rate than those who only took the energy for light. In the case of a lighting consumer who in a quarter purchased 300 units per kilowatt, he would pay for 91 units at the rate of 6d., and for 209 units at 1d., which worked out at 2·5d. per unit. The lighting consumer paid 2½d. per unit for his light. In the case of a power consumer who purchased 300 units, he paid a fixed rate of £1 per quarter, and for the 300 units 150d., or 1·3d. per unit. There was in the alteration of the scale issued in 1906 an added inducement to power consumers to take electrical energy from the Council for light at a cheap rate. Another inducement would be to take light also from the Council, which was an "undue preference" to the class of light consumers who were also power consumers.

His LORDSHIP: The Act says you may not give an "undue preference" to persons who take electrical energy for light.

Mr. RUSSELL: Under section 19, where a supply is provided for private purposes, then every person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other person within the area is entitled under similar circumstances to a corresponding supply. A light customer was entitled to a supply on the same terms as a power customer; and to give favourable terms to a power consumer in respect of the light, with the object of inducing him to become a customer, was on the authorities clearly wrong.

His LORDSHIP: You say that a person who takes energy for light is entitled to pay only for his light what another person in similar circumstances would pay.

Mr. RUSSELL said that a man who was paying 2·5d. per unit, if he found another person was getting his supply for lighting and power, was entitled to an equal reduction. Plaintiffs' case was really this—that defendants were supplying energy for light cheap to induce people to take electricity for power. There could be no complaint of their making a higher charge for light than they made for power; but the complaint was for supplying under the name "power" at a cheap rate electricity for light. On May 29, 1905, the Electric Light Committee reported as to the advisability of adopting a special price for factory power supply; the object being to get into the field before the Power Company, and at the Council meeting it was resolved that the report be adopted, though it was not acted upon then. On Jan. 29, 1906, another report was presented by the Engineer as to the existing rate of charges; and it was suggested that a substantial reduction should be made to 3½d. per unit for lighting. The report stated that in the Power Bills of the then session the proposed change gave the right to the power consumer to use 20 p.ct. of the energy supplied in the year for lighting, and went on to say: "We feel that the same concession should be given to our customers for power use." A flat-rate of 3½d. per unit was proposed. A new scale of charge for lighting was then proposed; and it was suggested that power consumers taking the whole of their supply under the maximum power rate might use, for lighting, 20 p.ct. of the total energy consumed. This report was adopted by the Committee, and subsequently a new scale was issued. In the Long Eaton case,* the decision of Mr. Justice Sargant was confirmed by the Court of Appeal; and in October, 1916, a new scale was issued with a slight alteration in the wording—that consumers paying under this scale were allowed to use not exceeding 20 p.ct. of the total energy consumed for lighting, provided "that the whole supply is taken from the same service and meter."

Mr. WALTER said this only expressed what the Council had done the whole way through.

Mr. RUSSELL submitted that the Long Eaton case decided that to charge A less than B to get A as a customer for another supply was illegal within the section; next, that if there were any circumstances affecting A as an individual which would render it less costly than to supply B, it would be justified. But this could not apply to the present case, which was merely a bait held out to a class. The effect of the circular on a customer who was taking energy from the Council for light and power before the change took place—taking light under A and power under B, who was consuming x units for light and 4·8 units for power—was that he made a demand for 5·8 units for power and applied 4·8 for power and 1·8 for light, and paid at a cheaper rate. The person was consuming the same amount of energy for his light; but he was paying half the amount of the rate—in fact, the better a man's load factor the less he was charged. If energy supplied for power by the Council was supplied at a loss, it meant that energy was supplied for light at a scale applicable for power which was produced at a loss. Even supposing it were produced at a profit, the Council were reducing their profit, and defendants were supplying at a load power rate energy which was to be used for the purpose of lighting—a result which could not be profitable. He did not think it necessary to call attention to the correspondence which led up to the action.

His LORDSHIP said he thought the point in dispute was a clean one raised on the sections of the Act.

Mr. RUSSELL agreed. As the power consumers had already got the reduction they were entitled to in the lower rate of charge, he could not understand why they were entitled to a further reduction. Having called attention to the Long Eaton case, and that of *The Attorney-General v. London County Council*, Counsel said the statement of claim alleged that the relators had since their incorporation supplied gas for lighting and other purposes within the limits of their district as from time to time defined; that the defendants, in the exercise of the powers conferred upon them, had at all material times supplied electrical energy for lighting and power purposes within their area. In July, 1914, defendants issued a circular to persons residing or carrying on business within their area, setting forth the scale of charges for lighting—the circular Counsel had already called attention to. The claim proceeded that since the issue of the circular defendants had supplied, and were continuing to supply, electrical energy for both lighting and power to consumers within their area upon the terms offered in the circular. Defendants, in supplying electrical energy upon these terms, were making a charge to consumers who took electricity for power as well as for lighting purposes under (*b*) alternative No. 1., and in thus differentiating the scale of charges between the two classes of consumers were committing a breach of sections 19 and 20 of the Act of 1882. Such differentiation occasioned a hardship to the consumers of electricity supplied by defendants, and was causing loss and damage to plaintiffs, who were ratepayers within defendants' district. By the defence, defendants denied that they differentiated between any customers in such a manner as to constitute a breach of sections 19 and 20 of the Act of 1882, and, alternatively, if by making charges to their customers in accordance with the circular they made a higher charge to those taking electricity for lighting purposes only than to those taking electricity for power as well as for lighting under (*b*) alternative No. 1 in the circular, they did not differentiate their scale of charges between two classes of consumers "under similar circumstances," and they did not commit a breach of either section 19 or 20. Having submitted that plaintiffs were entitled to the relief claimed, the following evidence was given.

Sir *John Snell* (of Messrs. Preece, Cardew, Snell, and Rider, Consulting Electrical Engineers), examined by Mr. COLEFAX, said he had studied the statutory accounts of the Borough of Hackney and the particulars disclosed in the action, and was well aware of the nature of the dispute between the parties. Using the various materials, he had made an investigation to see whether or not defendants had been supplying electricity at a profit or a loss. It appeared that profits had been made on private and public lighting, but losses had been made on the supply for power. By "load factor" one understood the proportion of actual number of units sold by any given amount of plant to the amount which could have been sold if the plant had been working for the whole number of hours in any year. By "diversity factor," if an undertaking were supplying a number of factories or premises, it was necessary to find, in fact, all the maximum loads which were measured by each of these factories if added together representing something more than the actual load observed at the generating station, and the difference in the ratio of actual load at the power station and at the consumers' premises was known as the diversity factor. Speaking broadly, the power users, as contrasted with light users, had a better load as a rule. Diversity factor supply had a much higher value than load factor. The higher the load factor, the lower the cost per unit of production; and the better the diversity factor, the cheaper and better it was for the

* See "JOURNAL," Vol. CXXVI., pp. 51, 130, 511. Vol. CXXVIII., p. 249.

authorities to produce power, as it would result in a lower charge per unit. The statutory accounts for the year 1913-14 gave the maximum load in kilowatts as 5254; the total number of units sold being 8,584,332. The actual cost of producing these units was £49,523, after deducting the cost of repairing street-lamps. The revenue received was £55,432. These figures could be located under three heads—private lighting, public lighting, and power, including factory lighting. There were no means of arriving at the figures from the books of the Council; the units used for public lighting were taken from the published accounts. On private lighting, a profit appeared to have been made of £9000, on public lighting £782, and on power (including factories) there was a loss of £4000. In 1916, the loss had increased considerably, although the profit on private lighting was maintained—in fact, the loss was four times as much, owing to the increased cost of coal. There was no justification for supplying factories with light at a cheaper rate than private houses.

Cross-examined by Mr. WALTER: In an electric light station, having regard to the machines, accumulators, mains, &c., the object was to utilize it as much as possible by day as well as by night. It was an advantage to the undertaking to get a day load; and a person who was going to take a day load was a great help to the undertaking as regarded the cost of production. It had always been the desire of station engineers to increase the day load at the station. He would not suggest that the circumstances of a person taking a day load were the same as one taking a night load, or that the one was entitled to more consideration than the other. A person who took energy for many hours was always better for the station than one who took for a few hours. If one had no day load, all the fixed charges were not being met. He was surprised to hear that with a drop of over a million units for lighting, and an increase of six millions for power, the loss on power had disappeared, and that over £6000 was being carried forward in relief of the rates this year. If this were so, the Council had done very well. As the figures for 1916 had not been given to him, he could not speak with regard to them. The cost of coal had gone up about 150 p.ct. recently, and this affected power more than lighting. The price in 1916 for lighting had been advanced 20 p.ct., and for power 30 p.ct. "Per kilowatt demand" meant at the power station, not at the consumer's premises. He did not know that all the public lighting in Hackney was by arc lighting, which was switched off at midnight.

WEDNESDAY, JULY 18.

Witness, in further cross-examination to-day, said that, speaking generally, as a class the power consumer had a better load factor than the light consumer; and there was a better diversity factor. As a rule, the power users, as a class, used a great deal more electricity than the light user class. All these factors were taken into consideration when fixing the price. In so far as a power user had 20 p.ct. of light, the load factor was slightly worse by this percentage—he had a better load factor and a better diversity factor and output than the light consumer. This entitled them, as a class, to a better price than the light user. The electric undertaking had primarily to determine the price. An ordinary municipal undertaking did not always start at a loss. Until there was a sufficient demand on the station, there would be a loss; but if the station was properly proportioned it would result in a profit. The profit of the undertaking ought to improve as it went on. The time might have been reached when the power charges at Hackney would result in a profit. Energy could not be distributed without loss; and, therefore, he had not charged the whole of the distribution loss to power and lighting. The proper method of dividing distribution loss, which amounted to from 15 to 20 p.ct. of the units, was to charge it to station and consumers' load. Witness was then taken at considerable length through the figures in different tables produced, showing the cost per unit sold as power with light consumers at different load factors, allowing for diversity, and the cost of supplying consumers with different load factors, allowing for diversity factors. It was suggested that, in arriving at the conclusion that the works were being carried on at a loss, witness had omitted to take certain matters into consideration; but he would not admit this, and said his conclusion was based on facts taken from defendants' books and not on pure theory, as he believed their conclusion to be. Witness, after looking at the accounts for 1916, said there appeared to be a steady rise in the load factor, which was what might have been expected. In the Long Eaton case, witness said he appeared for the Electric Lighting Corporation. There a power user was a good load factor, who was charged more if he did not take light than when he worsened his load by taking light. Unfortuuately, at the time, witness did not know all the facts of the case.

Mr. WALTER said he had read with some care the evidence given in that case; and he was of opinion that witness gave his evidence most fairly.

Re-examined: Witness said he knew of no special circumstances in the position of factory users so far as they used the power for lighting which would in any way justify the cheaper rate—in fact, it cost more to light factories than ordinary lighting. His own experience was that far more light was used in factories in the evening than during the daytime.

This was the case for the plaintiffs.

The Defendants' Case.

Mr. WALTER, in opening the defence, said it was necessary to consider what was the law with regard to the position of electric supply companies in relation to sections 19 and 20 of the Act of 1882. His submission would be that the action was entirely misconceived, founded on entire misconception of section 19 and of the Long Eaton case, which was an authority directly in favour of the present defendants. The "similar circumstances" and "corresponding supply" mentioned in section 19 had to be taken into consideration in seeing whether the person applying for a supply was in the same position as a person who was receiving a supply in the circumstances and facts relating to it. Now what were the facts here? The electric works were started in 1902; and the legitimate aim and object of every electric light company was to obtain as great a use as they could of the machinery which they had installed. The lighting load was normally an evening load; and if it was, the use of the machinery during the major portion of the day would be *nil*, though as some lighting would be required during the day the station had to be kept open and some of the plant running. Therefore, it had always been recognized that, taking classes of persons, the circumstances relating to a class of user that had a day load was different to the persons who only had the evening load. Power users were therefore charged on a different basis to lighting users.

His LORDSHIP: That is obvious.

Mr. WALTER: Because they are under "different" circumstances, and not under "similar" circumstances; the load factor at the station being greatly improved thereby, and the plant can be used during many hours of the day. Continuing, Counsel said that another well-recognized fact was this—that a class with a good diversity factor was entitled to be charged on a different scale to persons with the worst diversity factor, in so far as diversity existed, which meant that the peak of one and the valley of another did not apply—the same plant might supply double the amount of energy, as the demand did not exist at the same time. There was another diversity factor—namely, where a number of users carrying on different businesses had their demand, *inter se*, so varying from hour to hour that their chief demand did not come on at the same moment. In the Long Eaton case, the facts were these: Power users of over 6000 units were, if they took no lighting or only partial lighting, were charged on a basis of kilowatts demand, *plus* a charge of 1d. per unit; but if they took their whole lighting demand, though it worsened their load factor, they were entitled to obtain their current at the maximum demand rate of ¾d. per unit. The case was *ex facie* one of undue preference, in which power users, without any corresponding benefit to the supply company, were being charged more if they did not take current for lighting, though their lighting, if they took it, made it worse for the electricity undertaking. This was the principle on which the case was decided—there being a discrimination made without any countervailing advantages to the electric undertaking. It was not suggested in the present case that there was any difference between power users at all; every power user in Hackney was entitled to be served the same as everybody else. Evidence would be given that the supply had never been on any other basis than that set out in the circular of 1916—that consumers paying under the scale were allowed to use 20 p.ct. for lighting factories in which motors were installed.

Mr. RUSSELL pointed out that the allegation in the statement of claim was that since the issue of the circular of July, 1914, defendants had supplied, and were continuing to supply, energy to consumers upon the terms of the circular. This fact being admitted, it was not now open for defendants to go behind it.

His LORDSHIP said he understood Mr. Walter wanted to put in the circular of 1916, to show that they not only did not threaten and intend, but that throughout it had been understood that the factories had not power to supply private dwellings.

Mr. RUSSELL said defendants had admitted the issue of the circular of July, and that the supply was given on the terms therein mentioned. The circular was a clear breach of section 19.

His LORDSHIP thought it better to give leave to amend the pleadings by adding the circular of 1916.

Mr. WALTER said there was no discrimination in Hackney between a single power user—every one was entitled to come in on the system, and, if he took power for the factory, was entitled to use 20 p.ct. for light. That was to say, he had one supply coming into his works, and 20 p.ct. was the full allowance for factory light—this being the amount inserted by Parliament in Power Bills authorizing the supply of power in areas in which there was already a lighting authority, and Parliament recognized they were entitled to light the factory, and that power and lighting was one definite class of consumers. There was no discrimination among light users. Every one who chose to take it up could have the same scale; and every light user was entitled to have the same scale as power users. It was not even suggested that the circumstances under which a power user was entitled to take 20 p.ct. for lighting the factory was the same set of circumstances as any light user. It could not be suggested, because the load factor and the diversity factor were different. Therefore, he asked, where were the circumstances under which any light user was entitled to ask for light on the scale of power when he had not got power? As was put by Mr. Justice Sargant in the Long Eaton case, the class was intermediate between light and power; and why was this class not entitled to be treated on better terms than a light person only when the load factor and diversity factor were different and the quantity taken different? His suggestion was that the action was wholly misconceived. Whether the power user had light or not was characteristic of the light user. It had been suggested that the case came within the section not by showing that the circumstances were the same, but by raising a wholly fictitious case of an inquiry whether the supply for power paid or not. If it did not, it was a matter for the ratepayers and not for the Court. Once one found the circumstances were different, it was no part of the business of the Court to see whether the price charged agreed or not with the different factors. He craved in aid the principle upon which Mr. Justice Sargant decided the Long Eaton case as being directly in his favour. In the Court of Appeal, the circumstances were accepted as being the same; and in view of the finding of fact, it was held that no differentiation charge could be made—that, having regard to the finding in the Court below, that the circumstances of the two cases were similar, the proposed differentiation was a breach of the Act. There was no doubt that in the present case the circular might have been differently worded. The principle laid down by Mr. Justice Buckley in *Metropolitan Supply Company v. Ginder* was in favour of the present defendants. Then it was said that defendants had also committed a breach of section 20 by showing undue preference; but the Privy Council had decided, in *Attorney General v. Corporation of Melbourne*, that undue preference was an undue preference between persons of the same class, and not of different classes. He would not attempt to deal with all the facts that would be given in evidence, preferring that they should come from the witnesses; but he might mention that he proposed to call evidence to show that the theory upon which the accounts were put forward by Sir John Snell was quite a fallacious one. The

arithmetical deductions might be right, but the basis of the accounts was altogether wrong.

THURSDAY, JULY 19.

His LORDSHIP said the short point between the parties was as to the relative profits, between power and light, made by the electric undertaking during a particular period. Sir John Snell thought that energy for power would be supplied at a less advantageous rate than for light. But did that matter?

Mr. WALTER thought not. His evidence would go to show that there had been a profit on power in 1916-17, and that a loss of over £8000 had been converted into a profit of over £6000, although the lighting load had gone down about a million units. According to the plaintiff's theory, the defendants should now be in the Bankruptcy Court; whereas the fact was they had paid off a large amount of the reserve and were paying considerable sums in relief of the rates.

Mr. *Charles Hesterman Merz* (of Messrs. Merz & M'Lellen), examined by Mr. WALTER, said the cost of supplying electricity varied largely with the conditions under which the supply was given—due, firstly, to the high capital cost in electric supply systems; secondly, to the fact that electricity could not be stored; and, thirdly, to the fact that a large proportion of the operating charges depended rather upon the size of the installation than upon the amount of electricity turned out. The cost decreased enormously as the regularity of the supply increased, and *vice versâ*. The plant must be sufficient to supply the maximum demand. The effect of regularity of supply upon the cost of production was the most important factor. Two hours a day would cover a large number of light consumers. During the summer months the amount of current supplied had been largely affected by the Daylight Saving Bill. He agreed with the definition of load factor given by Sir John Snell. Diversity between two uses of electricity meant that one use took its maximum demand on the plant at a different time to the other. The relation between the sum of the different demands and the result of the demand on the station reduced (because the maximum demand was not at the same time) was the diversity factor. As a general class, in light consumers there was no diversity. There was great diversity in power users; and this was the chief reason why it was profitable, because it was used for the whole twenty-four hours, or because of the diversity between the different motors. A power user, as opposed to a light user, desired to have the highest possible load factor. It affected the wages bill and every other item in factory cost, and was thus reflected back to the station too. He had had considerable experience in connection with power users, having been the Engineer in connection with the Administrative County of London Bill. He was also Consulting Engineer to the North-East Coast group of companies, which turned out about a fifth of the total electricity of the country. With a large number of users for power, the diversity was greater. Electrical energy by the Power Acts was allowed to be supplied for power purposes; and it followed it was also necessary to supply light for factories, and 20 p.ct. was allowed to be used for this purpose. The electrical energy supplied took no notice whether it was supplied for power or light; the result being that in all large power businesses, which every undertaking must seek more and more to supply, the manufacturer would insist on being able to take his energy from one set of wires. One could not control the use of electricity for power or light, even if it was stipulated that the consumer should not use the energy for light. Power users, as a body, were larger consumers than light customers. It was of high importance to a company to obtain power consumers. This was proved by the fact that the undertakings which had gone in for power were increasingly successful, and those which had not had had their profits decreased. He had prepared a diagram showing the actual cost of electricity in Hackney without any diversity factor as being 0·348d. per unit. The fixed charges he put at £8, as against £7 mentioned by Sir J. Snell. He agreed with Sir John Snell that the ordinary diversity factor with power users would be 2 at a low percentage. The power business in Hackney was paying, and did so in 1913-14. The lowest charge was ½d. per unit, and the lowest cost was 0·348d. The fixed charges amounted to £12,000 per annum; and supposing this power had not been sold, the Corporation would have lost £12,000 right off. He had gone into the question of the actual demand with a view of trying to check the diversity factor. As the power business was the one which had a diversity, that was the one class of business whose combined demand could not be got from the consumers' accounts, as they did not know the coincidence of the light demand. The diversity factor of the other business was practically negligible. In order to ascertain the demands of the power users, it was right to take the demands at the station. In trying to get the cost to compare with the price charged to consumers, it was necessary to take the cost at the consumers' terminals. If one took it at the station, too low a cost was obtained. The output at the station was higher than at the consumers' terminals. From the accounts, there appeared to be a loss on the distributing system of 1,164,507 units—314,764 units at the works and show-room, and 126,315 on the accumulators, giving a total of 1,605,887. In ascertaining the number of units sold, one had to deduct from the units generated what was lost on the distributing system. Losses were highest at the peak, because on a direct current system there was no loss on low load, though there was an increasing loss on the high load. The system he had adopted to ascertain the cost was the one usually adopted to get at the rate to be paid by those who took power in the day time. During the period of non-peak load, the losses were less; and it was utterly unfair to charge these losses to the day load. The result of the power business was to put the undertaking in a better position by £12,000 a year.

Mr. *J. A. Jenkins*, Accountant to the Borough of Hackney, said he was familiar with the scale of charges in use. From the time the scale was introduced the practice of the Council had been as stated in the circular issued in October, 1916, for the lighting of factory and workshop premises. The accounts for 1916-17 showed that for lighting 1,825,075 units were sold; for power and factories, 12,465,635 units; and the amount carried forward was £6918, without taking into account £14,691 allowances to employees at the war. The net profit was £5456 after meeting every obligation. The capital to date was about £500,000. A large sum was paid off the capital except in the first two years, and there had been a good contribution to the rates during the period of the working of the undertaking. A reserve of £24,669 had been created up to March 16. There was a deficiency only up to 1902. Owing to the large increase in the cost of coal last year, £6000 had to be debited to reserve.

This was the case for defendants.

Mr. COLEFAX, in replying on the whole case, submitted that plaintiffs had clearly made out a case of undue preference. A circular was put out in 1905 which did not contain the preferential clause as to the 20 p.ct.; and had the matter rested there, it was probable the action would not have been brought. But when the alteration was made giving the option of using 20 p.ct. for lighting purposes, the result of which was that *quâ* lighting, there was a preference given to a man who was minded to take energy for power instead of using gas. On the authority of the Long Eaton case, he submitted plaintiffs were entitled to the relief claimed.

His LORDSHIP said he could not quite follow the reasoning of the Court of Appeal in the Long Eaton case. Why could not the undertaking give a better rate to the man who took a larger quantity than to one who took a smaller quantity?

Mr. COLEFAX said he thought they could legitimately do so.

His LORDSHIP: It seems absolutely dead-against the judgment of the Master of the Rolls if read literally. The Company said if a man takes all his power and light he should have it at ¾d. a unit; but if he only took current for power, it would be 1d. per unit. What is the difference to saying that if you take a larger quantity you shall have the current at a better rate than those who take a smaller quantity?

Mr. COLEFAX said according to the railway cases a company was entitled to differentiate between customers according to what they took; but they must not differentiate between purposes of user in order to induce a man to take current for a particular purpose.

His LORDSHIP intimated that he would take time to consider his judgment; and it has since been stated that it will be delivered to-morrow (Wednesday) morning.

Warrington Wages Arbitration.

The award of the Arbitrator (Mr. W. Addington Willis, K.C.), who recently conducted an inquiry at the Warrington Town Hall with reference to the wages of workmen (not permanent or clerical staffs) in the Gas Department, has now been received. This states that the rates of pay to all able bodied members of the National Union of General Workers of and over the age of eighteen shall be increased by 10s. 6d. per week above the rates existing on Aug. 4, 1914, and the rates of pay to male members under eighteen by 5s. 3d. per week. It is specified in the terms of the award that all advances by way of wages, war wages, and war bonuses, granted since Aug. 4, 1914, shall be merged in this increase, and that the payment of bonuses shall cease. The award and the increase are to operate as on and from April 11, 1917, and payments of advances and bonuses already made since that date are to be taken into account and credited as part payment of the increase. It is further stipulated that the "increase now awarded shall be regarded as war wages, and recognized as due to, and dependent on, the existence of the abnormal conditions consequent on the war."

Welsbach Light Company, Ltd.—At the annual meeting on Thursday, the Directors will report that the net profit for the year ended March 31 (subject to excess profits duty), is £30,512, to which has to be added the balance brought forward of £2040, making together a total of £32,552. The Directors recommend that a dividend of 5 p.ct. per annum be declared on the issued share capital, which will absorb a sum of £8750, less income-tax. It is proposed to carry forward the balance of £23,802, subject to any liability for excess profits duty. The effect of the scheme approved by the High Court some time ago is that the issued share capital is now £175,000 in £1 shares, leaving 90,000 shares unissued in the hands of the Company.

"Coalite" Information Needed.—Last week the "Pall Mall Gazette" wrote: Is it not time for the British Coalite Directors to make an official statement regarding the Company? The shares of the concern, with those of Coalite Ltd., have been hoisted so persistently that an explanation would clear-up a deal of mystery. In the absence of definite news from the Board, all kinds of rumours go round the market. Bearing in mind the history of the two Companies, we cannot do more than warn investors to act cautiously. It may be true that the Barnsley outlook is promising; the bye-products may be giving excellent results; and the talk about the antiseptic output may be correct. On the other hand, there may be a deal of exaggeration in all that is being said and written at the present time. Nothing appears to be known by the public, and for that reason the Directors should make an official statement without delay. The British Coalite annual figures will not be out until next December—a long time to wait; and an early authoritative announcement would be appreciated generally.

Sedgley Gas-Works Employees.—A letter from the Municipal Gas Workers and General Labourers' Union, respecting a war bonus for the gas-works employees, was read at last Tuesday's meeting of the Sedgley Urban District Council, and was referred to a Committee with executive powers. The letter was in these terms: "We think the conduct of your Council something of a scandal. An application was sent in on March 10, and in reply nothing has been received beyond a vague statement that the Council understood the whole question of wages was being inquired into. Whether you suppose a continuance of the inquiry and your procrastination in the matter will enable your employees to meet the ever-increasing cost of living is difficult for us to say. Scarcely any private or public employer with whom we have had trade union dealings has treated us so shabbily as you are doing in this matter. Your workmen are intensely dissatisfied; and we cannot be surprised that they desire our authority to throw down their tools. In the interests of common fairness, we hope you will give this matter your prompt attention."

MISCELLANEOUS NEWS.

EUROPEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Company was held last Tuesday, at Finsbury House, Blomfield Street, London, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. W. B. Brady) read the notice convening the meeting and the Directors' report, the latter being as follows:

The Company's business continues to be seriously affected by the prolonged war.

The shortage of freight renders it increasingly difficult to maintain the supply of coals at the Company's stations, while the lack of labour, so much felt in England, is even more serious in France.

Coals, freight, and labour have cost considerably more than in the previous year, with the result that the profits of the Company have been materially reduced.

The shareholders, however, are aware that reserves have been set aside in former years to meet unforeseen contingencies; and the Directors are of opinion that these reserves may now, after three years of war, be drawn upon to the desired extent without affecting the stability of the Company. They therefore recommend that a dividend of 5s. per share be paid on Aug. 1 next, making, with the interim dividend paid on Feb. 1 last, 10s. per share, free of income-tax; the balance necessary (£26,173) to make up such dividend being taken from the reserve of undivided profits.

An advance in the price of gas has been sanctioned at several stations; and, mainly on this account, the rental shows, in the aggregate, an increase of 14 p.ct. over the receipts of the previous year.

A very large proportion of the Company's staff abroad is serving at the front. As reported at the last meeting, the Board make allowances to the wives and families in all deserving cases.

The Company's concession for lighting the town of Bolbec has been extended for five years—until 1954—and the average length of the concessions is now 25½ years.

The Directors have to record, with much regret, the death of their colleague, Mr. Henry C. Smith, and of Mr. H. J. Luff, one of the Auditors. Pursuant to the regulations of the Company, the Directors have filled up the vacancies, and have nominated Mr. John Mews as a Director, subject to confirmation by the shareholders at the general meeting, and Mr. G. C. Goldsmid to act as Auditor until the general meeting.

The Directors who retire by rotation are Messrs. H. E. Jones and R. S. Gardiner: and the retiring Auditors are Messrs. J. Reeson and G. C. Goldsmid, who, being eligible for re-election, offer themselves accordingly,

SHIPS COMMANDEERED AND HEAVIER TRANSPORT COSTS.

The CHAIRMAN said it became his duty to move the adoption of the report and accounts. In doing so, he would follow the lines of the report, which, in the first instance, showed how difficult and serious were the ways in which the gas business was affected by the war. He did not think those present who were shareholders in English gas companies would need to be told of these difficulties; and they would realize very well how the anxieties of the Directors and staff here, and especially of the staffs at the works in France, must have been increased, and how heavy the burdens had been to bring the year's operations to the conclusion that they had before them. The difficulties were chiefly enhanced by the trouble of maintaining shipping supplies. The Company had made extraordinary efforts. It had raised capital from the bank—he was bound to say at a time of great difficulty—in order to enable itself to be in a position to ensure a delivery of coals to the French ports. He need not go into the history of what had taken place in connection with vessels crossing the seas. Especially had poor France been marked out for the most vindictive dealing with her fleets. By the great foresight of the Company's Managing-Director (Mr. W. Williams), they had acquired quite a satisfactory and most efficient fleet; but even at the eleventh hour, just before the Directors were meeting the shareholders, when they had on their lips nothing but smiles and encouragement, they had had the portentous information that the Admiralty had commandeered two of their fine boats which were running for them—true at a great cost, but still at a lower cost than if they had had to go out into the market for them. If they had not been running at a lower cost, they would not have had any excuse for incurring the capital outlay. They, of course, realized that the Government had to make provision for their requirements; but in place of these two fine, quick sailing, well-fitted boats—constructed specially for the coal trade—the Company would now have to rely upon the uncertain vessels of neutral countries, for which they would have to pay high rates This, to a certain extent, dashed the cup from the lips of the Directors; and they were not feeling that day so light-hearted as they hoped to have been in meeting the shareholders.

A SMALLER DIVIDEND AND WITHDRAWAL FROM RESERVES.

The profits were materially affected by these changes; and perhaps it would be as well, as they were going to recommend a dividend of 5 p.ct., free of income-tax, if he sketched shortly the position during the three years of war, especially as the report told them they were drawing on their reserves for a considerable part of the dividend. As the war had lasted three years, and as they had accumulated in past times reserves for equalizing their profits to enable dividends to be paid in times of duress, they thought they were fully well advised to recommend the shareholders to take from these reserves, and pay the modest dividend of 5 p.ct. Last year, it would be remembered, they received 7½ p.ct., and on that occasion they had to take from balances of one sort or another the sum of £5470. For the year 1914 they paid the full 10 p.ct., to which they had been accustomed, and the deficiency then was only £1802. They had that day to draw upon the reserves to the amount of £26,000 to pay the moderate dividend of 5 p.ct., free of income-tax.

WAR TIME INCIDENTS AND WORK.

In the midst of all this difficulty, there were some very encouraging features. He was bound to say that the way in which the French towns met their commercial obligations won the praise of everybody with financial experience. He was connected with companies working in countries which, though not actually at war, had been much affected by it; and he was sorry to say the money from them did not come in as they would like, and had a right to expect. But in France, though war was in the country itself, the money did come in, showing what an honourable, steadfast, righteous nation were these Allies of ours; for, while fighting for their ruined and martyred homes in these times, they sent the Company the money out of which they could pay their dividends. Bearing upon the commercial rectitude of their French customers, he should like to say that the arrears of rental at the end of March, 1914, amounted to £7707; and at the end of March last, the sum was £8285, or only about £580 more than they were before the war. This was striking evidence of what he had been describing to the shareholders. The honourable and rightful way in which those with whom they did business recognized their commercial obligations filled him with pride and admiration just as did the courageous, enduring way in which they were facing their enemies in the trenches and giving them battle. And here he was bound to say their own officers were loyally helping. A large number of the Company's men were fighting at the front. One of their own officers—M. Cros, the Engineer of the Boulogne works—the other day in the field received the great distinction of the Cross of the Legion of Honour. The shareholders, he was sure, would convey their congratulations to M. Cros, with those of the Directors, upon this distinction. ["Hear, hear."] They had lost Mr. Martin from the London office. He was going out to the front as an interpreting officer; and they had made arrangements towards assisting in his expenses, as, he was sure, the shareholders would wish the Board to do, and in a way, they hoped, that Mr. Martin would regard as being considerate, if not liberal and generous. As the shareholders were aware, the Board made allowances to the wives and families of the men who went to the front; and this extended as well to the officers. It would also be of interest to the shareholders to know that two of the Company's leading works had been equipped during the war time with apparatus and machinery for preparing certain munitions of war, with which work it was the pride and gratification of men like their Directors—Mr. Charles Carpenter, D.Sc., Mr. Gardiner, and himself—to be associated in this country. They were proud and gratified to know that in their various works they were assisting, as far as they possibly could, the nation in its hour of peril and in its hour of need for high explosives and other requisites for carrying on the war. These services had, in a speech made lately, been warmly and particularly eulogized by Lord Moulton, the Director-General of the High Explosives Department which served the British Army. And he (the Chairman) thought the shareholders would be glad to know that in France their Company was doing its share.

ADVANCED PRICES AND NEW AGREEMENTS.

Not only had the French recognized their immediate obligations to the Company in paying for the services the Company had rendered them fairly and liberally, which enabled the money to come over week by week. Some of the towns the Company supplied had, in obedience to a legal decision, entered into an agreement (and this without any rancour or ill-feeling on their part or that of the Company) whereby the greater part of their supply of gas now received an advanced price, which was a modest amount towards the losses which would otherwise have been sustained, and which would have extinguished the dividend. In one or two cases they had extended their concessions in the towns in which they worked; the last one before the report was prepared being Bolbec. The Board were also glad to tell the shareholders that since then the very important and valuable gas-consuming town of Nantes had likewise agreed to a settlement, by giving the Company an advanced price for gas and an extended term for their concession. At the same time this enabled them to dispose of two or three awkward and difficult outstanding questions. The Directors wanted to remove the works away from the centre of the town to lower down the river, where they had better means of getting in coal. This was a very anxious piece of work, which had engaged the attention of the Directors for some time past, while their Consulting Engineer had been going into it in detail with the local Engineers. This was a scheme that would have to be dealt with very carefully, because, when they destroyed works and threw them out of use, rendering them so to speak obsolete, if they had to meet the outlay by means of fresh capital, it would mean a very heavy financial burden; and this had to be reduced by dovetailing in the good of the old works with the developing powers of the new ones.

THE BOARD OF DIRECTORS.

During the past half year, they had lost their colleague, Mr. H. Chaloner Smith; and as they wished to strengthen the Board especially from the financial point of view, they had no hesitation in electing Mr. John Mews, who was a Director of the Union of London and Smiths Bank, with whom the Company had had an account for many years, and who had always dealt with them on very reasonable and fair terms. He was already a Director of the South Metropolitan Gas Company, and was known in the City as a most capable financial authority. The Board had therefore no hesitation in recommending the shareholders to re-elect him. The older Directors retiring by rotation were Mr. Gardiner and himself (the Chairman).

GOOD WORKING, BUT FORCED ABEYANCE OF REPAIRS.

With regard to the accounts, he should like to assure the shareholders that the working of all the stations of the Company was particularly good and satisfactory having regard to the conditions under which they were operating—many of them with insufficient labour, many of them without the repairs which they would ordinarily like to carry out on a larger scale. He wished them to understand that, when the war was over, repairs would necessitate for some time a heavier outlay than in the past, because it was now absolutely impossible to get either the material or the skilled labour for carrying out any such work.

The DEPUTY-CHAIRMAN (Mr. R. S. Gardiner) seconded the motion, which was unanimously carried.

THE DIVIDEND.

Moved by the CHAIRMAN, and seconded by Mr. JOHN MEWS, a resolution was passed confirming the interim dividend of 5s. per share, less

6d. per share for duty in respect of all shares held in France, and declaring a final dividend for the year ended March 31 last at the rate of 5s. per share free of income-tax, subject, however, to a deduction for French stamp and transfer duty of 6d. per share in respect of all shares held in France.

RE-ELECTION OF DIRECTORS AND AUDITORS.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, Mr. John Mews was re-elected a Director.

The DEPUTY-CHAIRMAN moved the re-election of the Chairman. He remarked that the Chairman always placed before the meetings of shareholders a descriptive bird's-eye view of the position of the Company in terms that were so easy to understand and so full of local interest that, from that point of view alone, the shareholders must appreciate how fortunate they were in possessing Mr. Jones as their Chairman. And those who had the pleasure of continually working with him knew how much the Company were indebted to him for the ceaseless attention he paid to all the details of the business—keeping himself in constant contact with the Managing-Director, and fully informed of every incident. And he (Mr. Gardiner) might say that in the difficult times through which they were traversing hardly a day passed without some incident or some difficulty for which there was no precedent to assist in guiding to a solution had to be dealt with under the Chairman's orders. He was always ready and eager to help. In addition, and apart from his invariable courtesy, they had the advantage of his great technical and engineering knowledge, and long experience in the profession in which he occupied the foremost place.

Mr. A. T. EASTMAN, in seconding, also referred to the value of such a combination of qualities as the Chairman possessed in meeting unforeseen and exceptional circumstances that had never arisen before in the Company's history.

The motion was heartily agreed to.

The CHAIRMAN moved the re-election of the Deputy-Chairman. He remarked that Mr. Gardiner had the advantage of the other Directors, except the Managing-Director, in being a fluent speaker, not only of his own tongue, but of the French as well; and he had the further great advantage of knowing the whole of the Company's stations from A to Z. He was, too, a member of the Société Technique du Gaz, and was (so to speak) as well known in Paris as in London. Coupled with this was the fact that Mr. Gardiner had occupied some of the offices in gas administration that he (the Chairman) had himself occupied; and he was now the Chairman and Director of certain important British and Continental companies.

Mr. CHARLES CARPENTER, D.Sc., seconded the motion, which was unanimously carried.

On the proposition of Mr. G. E. P. HODGE, seconded by Mr. FRANK H. JONES, the Auditors (Messrs. Joseph Reeson and G. C. Goldsmid) were re-appointed.

WELL-EARNED RECOGNITION.

The CHAIRMAN said they must recognize the services of the staffs in London and abroad, and pass to them a vote of thanks for their efficient services during the past year. This was really a very important vote, because where the Company would have been if it were not for their present officers during the past year and the years before, with the London staff depleted, he hardly knew. The London staff was almost as essential as the staffs abroad, although there was a broad distinction on the side of the men who were making gas and rubbing shoulders with their customers. With regard to their Managing-Director (Mr. Williams), he was sure the shareholders could appreciate, at a time when most foreign companies were passing their dividends altogether or paying dividends of much impaired amount, what they owed to Mr. Williams. He was glad to tell them the Directors had recognized this in a manner which he thought Mr. Williams would consider was fair if not liberal. As to Mr. Brady and Mr. Heather, the Auditors could tell them that the work of the office and the books went like clockwork. Having again mentioned Mr. Martin's departure for the front, the Chairman turned to the stations abroad. He said that M. Gautier, at Havre, had just accomplished his fiftieth year in gas service—though not all in this Company—and so the Directors had passed a vote recognizing the event and his services, and had sent him a handsome testimonial, which he had acknowledged with great gratitude. With regard to the rest of their officers, Captain Cros had earned the Cross of the Legion of Honour. M. Huon, who had been managing the negotiations for the increase of the price of gas and the extension of the concession at Nantes, was an accomplished officer. M. Coudelou, of Rouen, was a very hard-working and faithful officer. MM. Bertin and Defoy were doing their best in these troublesome times. How very anxious and troublesome these times must be when the issues of the war meant so much to them and their families the shareholders would realize. While their officers were devoted to their own country and to the Company, they were at the same time in hearty sympathy with the struggle through which this country was passing.

Mr. R. S. GARDINER seconded the motion, which was cordially passed.

The MANAGING-DIRECTOR (Mr. W. Williams) said, on behalf of all the members of the staff here and abroad and for himself, he thanked the shareholders most heartily for the vote they had passed. As the war continued to drag on, the shareholders quite understood the difficulties increased rather than decreased; and it was a great comfort to the Company's officers to know that their efforts were appreciated so thoroughly by the shareholders, and that they continued to enjoy their sympathy and support. He was sure that, when the vote was communicated to the Managers and staffs abroad, it would be appreciated as much by them as it was in London.

On the motion of Mr. REESON, seconded by Mr. HODGE, a vote of thanks was also passed to the Chairman and Directors.

The CHAIRMAN heartily acknowledged the vote.

Berwick Gas Company.—It was reported at the annual meeting of the Berwick Gas Company that there had been a serious decrease in the sale of gas owing to the Summer Time Act and the dull state of trade. A dividend of 7 p.ct. was declared, against the usual 10 p.ct.

MALTA AND MEDITERRANEAN GAS COMPANY.

Previous Results Well Maintained.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, Nos. 59-60, Gracechurch Street, E.C.—Colonel STEPHENSON R. CLARKE, C.B., in the chair.

The ACTING-SECRETARY read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

The CHAIRMAN, after expressing regret at the absence from the meeting owing to ill-health, of Colonel Daniell, went on to remark that since the shareholders had met a year ago the Company had passed through a period of considerable and increasing anxiety; and it was with considerable relief that the Directors saw, when the accounts were returned by the Auditors, that there was not a large difference between the results of the past year and the previous one. They started the year with a considerable increase in consumption; but as the freights for steamers were rising steadily against them, the Directors found that it was necessary to considerably increase the price of gas, with the natural result that the growth in demand was checked. During the latter months of the past year, there had even been a decrease in the consumption. The Board were fortunate in being able to hit upon a figure for the price of gas which had, in the result, balanced the extra costs to which the Company had been subjected. Needless to say, it was with great regret that the increase in price was made to the consumers; but the Directors were forced to it by circumstances. It was the only way by which the business could be conducted at a reasonable profit; and it would be a great relief to them when a fall in the rates of freight again enabled the Company to sell gas at a cheaper price. Touching upon the changes of the past year, he pointed out that Mr. W. A. Reid, their Engineer at Malta, after fifteen years' service with the Company, had retired, and the Directors had elected as his successor Mr. A. E. Buckley, who was for many years Engineer to the Holmfirth Gas Company. With regard to the accounts, the Chairman then proceeded to call attention to the greater differences between last year and the preceding one. Coals had cost £50,851, against £32,631 a year ago; and oil £4283, against £480. This left them with £22,000 to pull up. The sale of gas had brought in £50,642, against the previous year's amount of £37,520. Coke which a year ago produced £17,512, had now given the remarkable figure of £27,267; gas and coke together yielding £77,000, against £55,000 last year. Thus the sum of £22,000 deficient was exactly made up. The small increase in profis made on the sale of coal and tar had been more than covered by the loss in exchange from the Sicilian stations. This amounted in the year to the heavy figure of £3488, against £1197. This was partly caused by the increase in the rate of exchange, and partly by the larger sums that had been remitted from the stations at Trapani and Marsala; the Municipalities there having during the past twelve months considerably reduced their indebtedness to the Company. As to the future, he had just been alluding to the Sicilian stations; and he would continue his tale with regard to their expectations from them during the next twelve months. The story was soon told, for the Italian Government had taken them over for the duration of the war; and they would bring in no profit to the Company, nor would they be any expense. They were to be run at cost price; and the Company relied upon the fairness of the Italian Government that a sum would be allowed to the Company for amortization purposes. The supply of coals to these stations, and the price to be charged for gas and coke, would, until the war was over, remain the exclusive concern of the Italian Government. Now with regard to Malta. The great anxiety from first to last during the whole of last year, and for the ensuing year, had been, and would be, the supply of coal. Not that there was any difficulty in procuring coal on this side. The question was simply want of ships. It seemed impossible to tempt shipowners to risk their steamers on the voyage there; and for some time the Company had been unable to send out a cargo. For the last parcel of coal delivered there, they were indebted to the kind offices of the Admiralty, who informed them of a steamer going out; and they were enabled to purchase a portion of her cargo at £6 5s. per ton. The coal turned out quite suitable for gas making, and they were very glad to get it, and grateful to the Admiralty for their information. He concluded by moving the adoption of the report and accounts.

Mr. A. M. PADDON seconded the resolution, which was carried unanimously without discussion.

It was then agreed, on the proposition of the CHAIRMAN, seconded by Mr. A. F. PHILLIPS, that dividends be declared at the rate of 7 p.ct. on the first preference shares, 7½ p.ct. on the second preference shares (less income-tax), and of 6 p.ct. on the ordinary shares (free of income-tax)—deducting the interim payments already made.

The CHAIRMAN, proposing the re-election of Mr. Phillips as a Director, said the Company were peculiarly indebted to that gentleman, not only for the benefit of his personal experience, but for a great deal of work which had been carried out in his office, and which in these days of shorthandedness, owing to the war, could not otherwise have been got through. The Directors felt such a sense of gratitude to Mr. Phillips in this matter, that at the next meeting they would ask the shareholders to give him a small extra honorarium for the services thus rendered by his staff, and for the use of his offices.

Mr. PADDON seconded, and said that without the experience Mr. Phillips had freely given through his staff they could not have surmounted many of the difficulties by overcoming which they had been able to present the favourable statement now before the meeting.

Mr. E. L. BURTON supported the motion, which was carried.

Mr. PHILLIPS, in acknowledgment, said, with regard to the special services which had been alluded to, that what he had done he did without the slightest idea of receiving any compensation, such as was suggested by the Chairman.

On the proposition of Mr. F. R. SMITH, seconded by Mr. C. WEBB, the Auditors (Messrs. Burton and Cash) were re-appointed.

The Chairman, Directors, and staff were thanked for their services before the shareholders separated.

MANCHESTER CORPORATION GAS UNDERTAKING.

Annual Report and Accounts.

The following information and figures are taken from the report and accounts of the Manchester Corporation Gas Committee for the year ended March 31, a copy of which we have received from the Superintendent (Mr. Fredk. A. Price).

INCOME AND EXPENDITURE.

The income from the sale of gas for the past year was £688,095, and from residuals (including £21,226 from recovery of toluol, &c.) £313,370; the figures for the preceding year having been respectively £681,457 and £253,640. Adding sundry receipts, the total income reaches £1,002,570, as against £935,843. On the other side, the expenditure was £852,758, compared with £744,948; the gross profit for the year being £149,812, whereas twelve months ago it was £190,895. Deducting the amount (£56,032) paid for interest on loans, &c., a net profit of £93,780 is arrived at; the corresponding figure twelve months ago having been £141,234. The net profit has been appropriated as follows: Excess appropriation of £53,951 being carried forward to next year's account; deficit from last year's account, £34,009; sinking fund for redemption of loan debt, £61,047; city fund in aid of rates, £50,000; applied in extension of works where borrowing powers are not granted, £2675—total, £147,731.

The quantity of gas sold was 5,561,137,000 c.ft., a decrease of 2·44 p.ct. on the corresponding figures for the previous year; and the average price realized was 2s. 5·42d. per 1000 c.ft. The cost of coal and oil per ton carbonized was 18s. 1·39d., as against 14s. 9·6d. for the previous year; while the income from residual products rose to 12s. 5·71d. per ton, as compared with 10s. 0·06d. These figures represent an increase of 10·14d. per ton in the net cost of raw material, which on the carbonization of 502,377 tons amounts to £21,225.

The amount payable for income-tax for the year, according to the assessment, was £44,323, of which sum £9416 was recovered by deductions from interest payable on loans and stock, &c. There was also credited the sum of £21,443, being the amount refunded by the Finance Committee consequent upon the arbitration to determine the incidence, having regard to the Leeds judgment, of the income-tax payable by the Corporation. The net charge against the department for the year was thus £13,464. An appeal, however, is pending under section 13 (1) of the Finance Act, 1914, Session 2, on the ground of reduced profits owing to the war, which it is hoped will result in a considerable sum being credited to next year's account.

The amount transferred from revenue to the credit of the renewals account is £69,768, which, together with the interest on the fund, makes a total credit for the year of £74,129. The sum of £60,735 has been expended during the year. The balance to the credit of the account is now £158,753.

Additional loan capital to the extent of £10,000 has been raised during the year. The expenditure for the year amounts to £15,719. Of this sum, £2675 has been provided out of net profits, and the balance out of loans. The total capital outlay at March 31 last was £3,099,346, the loan debt in respect of which was £911,448. The balance of sinking fund not actually applied to the redemption of debt at the same date was £44,013.

PRICE OF GAS.

The Committee regret that, owing to the increased cost of oil and other materials and of the war bonuses to employees, they have been compelled to recommend an advance of 6d. per 1000 c.ft. in the price of gas to all consumers. This advance, together with that approved by the Council on May 5, 1915, makes a total increase in the price, consequent upon the war, of 1s. per 1000 c.ft. The recommendation was approved by the City Council on May 23 last, and the new scale of charges, which took effect as from the readings of the meters for the June quarter, is as follows:

Gas consumed on one premises per quarter.	Price Within the City.	Price Without the City.
	Per 1000 c.ft. s. d.	Per 1000 c.ft. s. d.
ORDINARY METERS—		
Under 250,000 c.ft	3 2	3 5
250,000 and under 1 million	3 1	3 4
1 million and under 2 millions	3 0	3 3
2 millions ,, 3 ,,	2 11	3 2
3 ,, ,, 4 ,,	2 10	3 1
4 ,, ,, 5 ,,	2 9	3 0
5 ,, and upwards	2 8	2 11
GAS ENGINES—		
Under 1 million c.ft.	2 9	3 0
1 million and under 2 millions	2 8	2 11
2 millions and upwards	2 7	2 10
All these prices are subject to a discount of 2d. per 1000 c.ft. for payment within one month.		
PUBLIC STREET LAMPS	2 6	2 9
AUTOMATIC METERS—		
Cubic feet per penny	25	23
These prices are net.		

THE WAR.

At March 31, 826 employees had joined His Majesty's forces. The Committee record their deepest sympathy with the relatives of 59 employees who had made the supreme sacrifice. There are 108 employees at present engaged in the department who have served during the war in either the army or navy, but have been discharged on account of wounds and various other reasons. At March 31, 100 women were employed as clerks and meter readers, and 71 as manual workers.

The amount standing to the credit of the war benevolent fund at March 31 was £701. The officials of the department voluntarily contribute to this fund, thereby showing in a practical way their sympathy with the dependants of fallen colleagues or with those who have been incapacitated through service with the colours. A number of cases have been relieved during the year. The Committee of Management hope to maintain the fund without appealing to the Gas Committee for financial assistance.

In accordance with the resolution of the Committee, gas is still being supplied to the Belgian Hostels and the Red Cross and Voluntary Military Hospitals at one-half the usual price. This concession costs the Committee about £1000 per annum.

The war bonuses payable at March 31 were:—

	Per Week. s. d.
Shift-workers (including Sunday)	8 7½
Day-workers	7 6
Distribution department	6 6
Clerical, collecting, and inspection staffs up to £300 per annum	6 6
Tradesmen—according to the various trade rates	—
Women and Youths	3 3

SUMMER TIME ACT, 1916.

There was an estimated decrease of 110 million c.ft. in the consumption of gas owing to the operation of the Summer Time Act from May 21 to Oct. 1. The decrease is equal to 1·8 p.ct. on the annual consumption. The Act operates this year from April 8 to Sept. 17.

GAS-HEATED FURNACES.

To promote and further the use of gas for industrial and manufacturing purposes, two gas-furnace demonstrations have been held during the year at the Whitworth Street Depôt. Representatives of a large number of important engineering firms attended and took advantage of the facilities offered for testing materials and making experiments with various types of furnaces. A third demonstration will shortly be made. A fully-equipped and permanent furnace-room is in course of completion at the Whitworth Street Depôt; and it is intended to offer continuous facilities for testing and experimenting with all makes of furnaces and other heating appliances.

STATISTICAL.

The following particulars are furnished as illustrating the growth and working of the department during the year:

—	Year 1916.	Year 1917.
MANUFACTURE—		
Material carbonized—tons	507,912	502,377
Gas made—Thousands cubic feet	6,067,751	5,901,971
,, per ton—cubic feet	11,968	11,748
Calorific value, B.Th.U. (gross)	539	519
Coke available for sale—cwt. per ton of coal	11·18	10·85
Tar made—gallons per ton of coal	12·23	11·17
Ammoniacal liquor made—10 oz.—gallons per ton of coal	30·20	30·75
DISTRIBUTION—		
Mains—Miles laid	992¾	994
Output of gas—Thousands cubic feet	6,067,094	5,902,652
Gas sold ,, ,, ,,	5,700,014	5,561,137
Gas unaccounted for (adjusted) ,, ,,	194,673	179,885
,, ,, ,, per cent. on output	3·21	3·05
Total number of consumers (including automatic)	190,956	192,886
Number of automatic consumers	74,506	77,725
Gas sold to automatic consumers—Thousands cubic feet	998,880	959,541
Gas cookers and fires:—		
Number fixed and owned by Committee—		
Cookers	86,137	89,957
Grillers	37,661	37,794
Fires	20,511	23,049
	144,309	150,800
Gas consumed (estimated)—		
Cookers and grillers—Thousands cubic feet	1,083,500	1,129,500
Fires—Thousands cubic feet	235,000	270,500
Per cent. of consumers with cooker, griller, or fire	76	78
Private Lighting—		
High-pressure lamps	1,016	1,076
Low-pressure lamps	1,025	990
Burners maintained	24,984	26,674
Public street lamps—		
Within the city	21,442	21,304
Without the city	1,421	1,419
	22,863	22,723

Public street lighting restrictions: There was a decrease in the quantity of gas supplied for the public lamps of 74,857,000 c.ft., equal to 1·27 p.ct. on the output.

EXTENSION AND RENEWAL OF WORKS.

Bradford Road Station.—One-half of the reconstructed No. 1 retort-house, equal to thirteen settings of horizontal "through" retorts, ten retorts to a setting, has been completed and put to work during the past winter. A power-house containing two 200 KW. Browett and Lindley dynamos and engines combined is nearing completion, which will ultimately provide power for the electrical machinery in various parts of the works. A railway connection is being constructed between the railway sidings and the works, by means of an inclined road. This work has made good progress during the past few months, and is expected to be ready for use during the coming winter. A small pump-house, containing six pumps (driven by electricity), has been erected for dealing with tar and liquor; but owing to the shortage of labour it has been impossible to put the plant into operation.

Droylsden Station.—The No. 1 vertical retort setting has been rebuilt during the year.

High-pressure Mains.—High-pressure mains varying in diameter from 2 to 9 in. have been extended during the year; for the purpose of street lighting and private consumers. The total length now laid is 12¼ miles 174 yards.

GENERAL.

The Government are still being unreservedly assisted in various ways by the department.

The Committee deeply regret to record the loss by death, after a long illness, on Dec. 16, 1916, of their Deputy-Chairman, Alderman Thomas Hassall, J.P., who had been an active and valued member of the Gas Committee for 18 years, and was held in high esteem by his colleagues.

MR. PRICE'S STATISTICS.

Mr. Price has again brought up to date the statistics compiled by him, which indicate at a glance the position of the undertaking in every resspect as compared with the previous twenty years. The excess of assets over liabilities is shown to be £2,319,247. Capital charges amount to 4·54d. per 1000 c.ft. of gas sold, and the net profit to 4·05d. The production of gas per ton of coal carbonized was 11,748 c.ft., of a calorific value of 519 B.Th.U. gross. The following is the appropriation of net profits from 1844 (the year in which the works were taken over by the Corporation) to March 31 last.

Paid over to Improvement Committee for improvement purposes, 1844 to 1887 inclusive . .	£1,367,641	8	11
Paid over to Water-Works Committee (one moiety of profits from 1852 to 1861 inclusive). . . .	166,265	4	7
Cost of street lighting from 1879 to 1891 inclusive, borne by the Gas Committee	329,201	13	2
Paid into City Fund, 1888 to 1917 inculusive . .	1,454,066	5	7
Total amount applied in lieu, or in aid, of city rates	£3,317,174	12	3
Total cost of land, buildings, and plant to March 31, 1917	£3,099,346	14	1

On this occasion, Mr. Price has introduced a new table, which shows how the day consumption is growing as the result of the extended use of cookers, furnaces, &c. Whereas in 1908 the day consumption was 32·92 p.ct. of the total, for the past twelve months the proportion had grown to 45·31 p.ct.

BIRKENHEAD GAS-WORKS RESULTS.

In the statement of working results which accompanies his analysis of the accounts for the year ended March 31 last, Mr. R. H. Brown, the Gas Engineer to the County Borough of Birkenhead, says the quantity of gas sold during the year was 917,413,000 c.ft., which was a decrease of 11,180,000 c.ft. The decrease in consumption up to Dec. 31 was very much greater than this; but the unusually wintry nature of the March quarter greatly assisted in reducing the decreased consumption—the increase on that quarter alone being equal to 10·5 p.ct. This increase, together with the whole year being affected by an increase in the price of gas made in June, 1915, led to an increase in the gas-rental of £4406, though this was considerably off-set by the decrease in public lamp consumption of £3623.

Residual products show an increased revenue of £9639, compared with the previous year, principally due to the improved prices of coke; and this return should have been even better, but for the fact that in the early part of the year one or two old contracts at low prices were still being carried, and the low prices paid by departments of the Corporation. The old contracts are now finished, and improved prices have been obtained from the other departments. Tar brought in less during the year, in consequence of the difficulty of disposal of pitch; and ammoniacal liquor also brought in considerably less, owing to the new prices which had to be accepted from the sole buyer.

On the expenditure side, coal cost an average of 21s. per ton, against 18s. 2d. per ton the previous year, in which the arrears of several old contracts were being worked off. This increase in price on the average quantity of coal used (neglecting the increased coal used in place of carburetted water gas manufacture) amounted to £5600. The increase in the rate of income-tax from 3s. to 5s. in the pound accounts for £3221 out of the £8053 paid, apart from the increase due to larger assessable profit. Increases in wages granted during the year amount to approximately £2000. These sums, together with the £919 expended out of revenue on capital account, make the total increased charges of £11,812 against profits. The cost of all materials for maintenance and other purposes was also considerably higher, which further decreased the available surplus.

The total gas made during the year was 1,010,917,000 c.ft., a decrease of 3,954,000 c.ft., equal to 0·39 p.ct. The coal used amounted to 67,656 tons, against 54,947 tons in the preceding year; but no carburetted water gas was made for five months, in order to economize the oil and coke, which accounts for the increased coal used. The make of gas was 12,466 c.ft. per ton of coal, against 12,143 c.ft., an increase of 323 c.ft. per ton, effecting a saving of 2350 tons of coal. The total coal gas made was 843,259,000 c.ft.—the balance being made up of carburetted water gas. The coke sold per ton of coal equals 11·45 cwt., against 10·2 cwt., an increase of 1¼ cwt. per ton. The tar made—13·95 gallons per ton of coal—compares with 14·5 gallons, a decrease of 0·6 gallon; and the liquor made equals 29·91 gallons of standard strength, compared with 30·8 gallons. These are all good standard figures; the make per ton and the coke sold per ton being a record for these works.

The attention of the Committee is directed to the figures with reference to distribution, from which it is seen that, in the matter of cooking-stoves, the department is approaching saturation-point in proportion to the number of consumers, and that stoves are a decided asset in the consumption of gas apart from the other business done in them. As to the future, it is to fires and hot-water apparatus that the department must look for a further increase of business.

Relations with employees have been amicably maintained during a very difficult and strenuous year; and it has been largely due to the wholehearted co-operation of the staff and employees that the results have been kept at the present standards, at a time when extraordinary charges have to be met, and all sources of expenditure and income carefully watched.

GAS PROGRESS IN DUNDEE.

[From a Scotch Correspondent.]

An examination of the accounts and statistics of the Dundee gas undertaking reveals remarkable progress. The undertaking was acquired by the present owners—the Dundee Gas Commissioners—in the year 1868. The price charged for gas then was 5s. 4d. per 1000 c.ft. During the next few years it was gradually reduced to 4s. 2d.; but in 1873-4 it was raised to 6s., which represents the high-water mark as regards price. From that year until 1883-4 the price fell by stages to 3s. 6d., at which it remained until 1886 7, when it was put up to 3s. 10d. In 1900-1 the rate was again 3s. 10d., the price in the interval having fluctuated between that figure and 3s. 2d. The next year the charge was reduced to 3s. 6d., whence it steadily dropped, until in 1911-12 it was only 2s. 2d. At this price it remained for four years, when abnormal expenses due to the war compelled an increase to 2s. 9d.

The quantity of gas made in 1869-70 (the first complete year) was 200,838,000 c.ft.; in 1916-17, it was 1,104,038,000 c.ft.—an increase in 47 years of 449 p.ct., or an average annual percentage of 9·5. This is a record on which any gas undertaking might legitimately plume itself. In the 35 years from 1869-70 to 1904-5 the average annual increase in the quantity of gas made was 13,793,000 c.ft. During the twelve years that have since elapsed, the average was 35,035,000 c.ft. This growth is so rapid and striking that one seeks among the Commissioners' statistics for a cause. It appears to be found in the fact that in 1905-6 they adopted, on the recommendation of their present Engineer (Mr. Alexander Yuill), what has been tersely described as the "forward policy." They decided that is, that they would not wait while their consumers were slowly discovering the advantages of gas for cooking and other domestic purposes, and were weighing and balancing the arguments for and against hiring the necessary appliances, but would, in a spirit of brave confidence in their commodity, brush-away all restrictions, and offer to supply on free loan gas-cookers, hotplates, grillers, and gas-rings. On April 30, 1905, the cookers on hire numbered 2264; on May 15, 1917, the number on free loan was 14,315, and there had also been supplied on the same terms 1753 hotplates, 4544 grillers, and 10,110 boiling-rings—a grand total (in more senses than one) of 30,722. These good results spurred the Commissioners in 1909-10 to take another step; they determined to supply on hire gas fires, radiators, and geysers, of which there are now 11,613, 1807, and 107 respectively. This, then, is the main cause of the development of the undertaking since 1904-5, and of the reduction in price from 2s. 10d. to 2s. 2d. per 1000 c.ft.

During the past decade, the quantity of gas made per ton of coal used has risen from 9627 to 11,579 c.ft. The annual figures are as follows:

1906–7	9,627	1912–13	10,829
1907–8	9,387	1913–14	10,926
1908–9	9,849	1914–15	11,024
1909–10	9,702	1915–16	station meter defective.
1910–11	10,446		
1911–12	10,876	1916–17	11,579

The practical effect of this improvement is seen when it is stated that if in 1916-17 the quantity of gas made per ton of coal had been the same as in 1906-7, about 18,700 additional tons of coal would have been required, costing, at 20s. 2·63d. per ton (the average price given in the Commissioner's statistics for last year) no less than £18,900.

In the year 1869 70, nearly one-fourth (24·25 p.ct.) of the gas made was unaccounted for. This high percentage was brought down to 10·66 in the year 1883-4. In 1886-7 it fell to 7·91, and from then to 1916-17 the average works out at 7·88. It is rather high, but probably some special local conditions account for it.

The charges for annuities, interest, sinking fund contributions, &c., have come down from 1s. 2·32d. per 1000 c.ft. of gas made to 6·85d. in the year 1914-15. War conditions caused a rise in 1915-16 to 7·67d., and in 1916-17 to 8·06d. This is a low rate for an undertaking acquired from a private Company. It indicates that great discretion has been used in the matter of extensions, and that a wise policy has been adopted in regard to the allocation of expenditure as between capital and revenue. The total amount expended on capital account at May 15 last was £798,158, which is equal to £723 per million cubic feet of gas made.

The loss in bad debts in 1869 70 was 20s. 6d. per £100; last year, it was 7d. The record is held by the year 1913-14, with the extraordinarily low figure of 5d. No doubt the facts that 5 p.ct. discount is allowed for prompt payment of gas accounts, and that almost exactly one-half of the Commissioners' 51,832 consumers take their supplies through prepayment meters, partly account for this excellent result; but even after making due allowance for these things, the figure is highly creditable to the financial department.

The Commissioners' accounts are stated with clearness; and the statistical statements at the end of them are useful and interesting. But why is the usual method of placing credits on the right and debits on the left reversed?

Quality of Brentford Gas.—The Heston and Isleworth District Council report that complaints have been made as to the poor quality of the gas at present supplied by the Brentford Gas Company, and they have been urged to make some representation to the Company in the matter. The Council proposed to send a letter to the Company directing attention to the low calorific value of gas now supplied, and to send a letter to all Urban District Councils within the area supplied by the Company, informing them of the representation made as to the quality of the gas, and urging them to take similar action.

THE ASHTON CHEMICAL EXPLOSION.

Dismantling at Ashton Storage Station.

Excellent progress is being made at Ashton-under-Lyne with the work of dismantling the two gasholders wrecked by the decent disastrous explosion [see "JOURNAL" CXXXVIII., pp. 586, 620, 621]; and, given fine weather and freedom from labour difficulties, the Contractors (Messrs. R. & J. Dempster, Ltd., of Manchester), are hopeful of having one of the holders ready by October. Although the task is an unusually ugly one, they have tackled it with spirit and enthusiasm—an enthusiasm which is shared and appreciated by Mr. Joseph Townsley, the Engineer and Manager of the Ashton Gas Company, who, with his increasing consumptions, will be in an anxious position until he can get one of the holders going again.

An interesting fact has come to light with regard to the contention of Mr. Townsley that portions of the chemical plant were blown right through the holders, for parts of the still from the chemical works can be seen inside the holder that is dry.

Both the new holders will, it is understood, be spiral-guided.

RENEWING THE DUKINFIELD PLANT.

A full supply of gas has been available at Dukinfield for some time now—thanks, largely, to the energy of Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Stockton-on-Tees, who had gangs of men and quantities of material on the job with commendable celerity and dispatch soon after the explosion. The records at Dukinfield—as verified by Mr. William Lindley, the Engineer—show that gas-making ceased at 4.24 p.m. on June 13, and that the supply was renewed at 10 a.m. on July 3; no mishap of any kind taking place when the gas was turned on to the town supply. Besides repairing No. 2 holder and rendering it fit for gas making in so short a time, the Contractors have been engaged in putting new steel roofs over Nos. 1 and 2 retort-houses—their predecessors having been so badly dented and perforated by flying portions of the chemical works plant that it was necessary to practically dismantle them. The engine-house, meter-house, purifying-house, and other parts of the works have also received attention at their hands.

The contract for the new double-lift holder (to replace No. 1 holder) was, as previously stated in the "JOURNAL," let within forty-eight hours of the explosion. This work has been entrusted to Messrs. Newton, Chambers, & Co., Ltd., of Sheffield, who are hopeful of completing it in four months.

ALLOA GAS DEPARTMENT.

The financial statement for the past year was submitted last week to a meeting of the Town Council by the Convener (Bailie Henderson). The total income was £24,715; and the expenditure, £18,398—leaving a gross profit of £6318. The sinking fund amounted to £2594; and interest to £1719; property and income-tax, £1196; and bad debts, £16—leaving a net profit of £793.

It was agreed to write-off in the sinking fund account an additional sum of £700. It was stated that with the present rate of payment to the sinking-fund the whole debt of the undertaking was being written-off in 13½ years. The capital cost of gas-cookers has already all been written-off. The quantity of gas sold increased by 3½ million cubic feet. The coal carbonized was 11,209 tons; gas per ton of coal for the year, 14,013 c.ft., compared with 12,800 c.ft. for the previous year—the former figure having been obtained by suitable steaming in the vertical retorts. The coke saleable was 10·57 cwt. per ton of coal carbonized; tar, 16·38 gallons; sulphate of ammonia, 29·80 lbs.

An estimate of income and expenditure was submitted for next year, showing a net profit of £723. It was agreed to continue the present rates for gas—viz., 2s 5d. for lighting and 1s. 8d. to 2s. 2d. for power.

WAGES ARBITRATION AT THE BURY GAS-WORKS.

The Multiplicity of Trade Unions.

The gasworkers employed at the Bury Corporation undertaking are divided into two camps for trade union purposes—three-fourths of the men being members of the Bolton and District Gasworkers' Association, and one fourth the Municipal Employees' Association. Unfortunately, however, the two Unions have not in the past acted jointly in the matter of war wages and war bonuses; and the result has been confusion of purpose all round. An effort to clear the air was made last Thursday by the Chief Industrial Commissioners' Department—Mr. Vesey Knox, K.C., M.P., opening arbitration proceedings in the Council Chamber. The Gas Department was represented by the Town Clerk (Mr. J. Haslam) and Mr. H. Simmonds, F.C.S., the Engineer and Manager.

It was stated at the outset of the proceedings that early in the year the Gas Committee received a deputation from the Bolton Gasworkers' Association only; and the Association accepted an advance of 3s. a week as war wages. The Municipal Employees' Association protested against the Gas Committee declining to receive a deputation from them, and passed a resolution to call the attention of the Chief Commissioners' Department to the "inequality." In May, the Bolton Association applied for a further advance of 6s., and (after an arbitration held with regard to the wages of gasworkers at the Farnworth and Kearsley undertaking) they agreed to accept the award of 4s. No agreement having been come to regarding the war wages of Municipal Employees' workmen, these arbitration proceedings followed.

Mr. P. J. TEVENAN, the General Secretary of the Union, in submitting their case to the arbitrator, said they desired an increase of 7s. a week, on the ground that the cost of living had increased since the last grant was made. They thought the application was justified. The Ministry of Munitions had granted an all-round increase of 12s. to men in certified trades; and they thought they were entitled to a similar increase.

The TOWN CLERK pointed out that the Gas Committee had dealt with the Bolton Gasworkers' Association, who represented the majority of the employees at the Bury Gas-Works, and they had accepted 4s. This amount had also been accepted by the gasworkers employed at the Radcliffe and Pilkington works, and at Farnworth and Kearsley. The majority of the Bury men had accepted the increase to date from March 28; and he contended that it was unreasonable that another Union, representing the same class of workers, should come and ask for an amount over and above what the majority were prepared to accept. Many of the men represented by the Municipal Employees' Association were old men, between 60 and 70 years of age, and they were not justified in asking for such an advance for the old men.

Mr. TEVENAN, in reply, said there were not many old men employed at the works; but the old men who were there were old servants of the Corporation. As to the majority having accepted the Farnworth award, out of 131 employees in the Gas Department 54 were in favour of acceptance and 36 against. Those who accepted the award were not all members of the Bolton Gasworkers' Association—seven or eight Unions being represented in the gas-works. Every Committee of the Corporation except the Gas Committee recognized the Municipal Association.

Mr. VESEY KNOX asked why the two Unions could not act jointly in the matter; and he was informed that the Bolton Association had refused to work with the Municipal Association. The position had also been complicated by the attitude of the Bury Gas Committee in declining to recognize the Association.

In the result, it was announced that the Committee on Production having recently awarded 3s. all-round to men in certified occupations, it was agreed that this should be taken into consideration in the present arbitration; and the representatives of the men agreed that they would make no other application for six months from the date of the award.

STOURBRIDGE GAS-WORKS REPORT.

In his twelfth annual report, dealing with the working of the Stourbridge Gas Department for the twelve months ended March 31, Mr. Charles H. Webb (the Engineer and Manager) says the sales of gas by both ordinary and prepayment meters show decreases (of about 2,000,000 c.ft. under each heading), largely due to the working of the Summer Time Act last year. Public lighting was further reduced from 11,100,000 c.ft. to 1,400,000 c.ft. The gas manufactured was 15,362,000 c.ft. less than the previous year; and the gas unaccounted for was reduced by 1,344,300 c.ft.

On revenue account, the continued high price of coal and other materials has had its effect on the expenditure side. No advance in the price of gas has been made during the year; and income from this source is slightly less than last year, chiefly due to reduced public lighting. The increases in the price of gas at present in force, as compared with pre-war rates, are: Ordinary lighting and power, 4d. per 1000 c.ft. and prepayment supplies 1⅜d. per 1000 c.ft. Residuals show good returns, yielding 76·26 p.ct. on the cost of coal and oil, as compared with 58·58 p.ct. last year. The balance carried to profit and loss account is £14,685. After making the deductions for income-tax (which has increased from £1602 to £2750), and annual instalments and interest, the surplus is £5109. The alterations required to permit of oil-washing for benzol recovery are nearly completed; and this process will shortly be in operation.

From the working statement, it appears that the gas made amounted to 241,667,000 c.ft., of which 236,042,000 c.ft. was coal gas. The make of coal gas per ton carbonized was 12,833 c.ft., and the sale 11,622 c.ft. The percentage unaccounted for was 7·32.

COKE-OVEN GAS FOR LIGHTING.

An Absurd Sheffield Decision.

In the "JOURNAL" for May 8 [p. 226] a comment appeared upon the ridiculous decision of a House of Commons Committee prohibiting the Sheffield Gas Company from distributing coke-oven gas for lighting purposes. In a reference to the matter last Friday the "Iron and Coal Trades Review" also sees the absurd side of the decision. It says: "The point seems to have attracted no general attention; but it is of no little importance at the present time. In Sheffield itself, even, the importance of the question does not seem to be fully realized; for although the City Council have deliberated upon it, nothing has been done, nor is any action contemplated apparently. As matters stand, therefore, if the steel and other trades of Sheffield are to have supplies of coke-oven gas, the streets of the city must be torn-up and the cost of laying separate mains incurred; whereas it would be comparatively simple and inexpensive to purify and conduct the gas through the existing pipes mixed with the ordinary town supply, which is the method already adopted, we believe, in Middlesbrough, Leeds, and Birmingham. No later than last winter, Sheffield was short of gas, and the manufacturers everywhere were crying out for it. The new control of the coal industry may, or may not, ensure better results during the coming winter; but it is surely folly to wantonly neglect so cheap and convenient a source of supply; and if separate mains are insisted upon, it seems probable that Sheffield will have no coke-oven gas at all. The same arguments, of course, apply to other centres; and it is to be hoped that they may be noted and inwardly digested by House of Commons Committees who are called upon to deal with such questions. Perhaps the Coal Controller will move in the matter. We understand that his attention has been called to it; and we should not be surprised if he took some action, for it certainly seems absurd that at a time when there is a coal shortage, and every nerve is being strained to relieve the pressure, both present and prospective, on the railways, thousands of tons of coal should be unnecessarily conveyed into Sheffield or any other town. Even where

all the coke-oven gas produced is consumed under the colliery boilers, so that there is no actual waste of our national fuel resources, the transport advantage remains to be considered, and, in conjunction with the comparatively small cost of making a connection with the existing town system, should be sufficient to outweigh the decision of any House of Commons Committee under present circumstances."

UTILIZATION OF IRISH PEAT.

The Fuel Research Board, with the sanction of the Committee of the Privy Council for Scientific and Industrial Research, has appointed a Committee of Inquiry into the utilization of Irish peat deposits.

The terms of reference to the Committee are as follows: "To inquire into and to consider the experience already gained in Ireland in respect of the winning, preparation, and use of peat for fuel and for other purposes, and to suggest what means shall be taken to ascertain the conditions under which (in the most favourably situated localities) it can be profitably won, prepared, and used—having regard to the economic conditions of Ireland; and to report to the Fuel Research Board."

Though the inquiries of the Committee will (the official intimation states) ultimately lead up to the consideration of peat as a source of energy in central power stations, there are sound reasons why this aspect of the problem should be postponed to a later stage. On the one hand, the Fuel Research Board is already organizing an extensive inquiry into the problems of fuel economy in connection with power production; and the results of this inquiry will supply the fundamental data and information which will be required when the time comes for the consideration of any wide scheme of development in Ireland. On the other hand, any schemes of development must be based on a more exact knowledge than is at present available regarding the selection of the more favourably situated bogs, and the possibilities of winning and transporting partially dried peat to centres at which it may be converted into marketable products. It is obvious, therefore, that the inquiries of the Committee are likely to be most fruitful if they are concentrated on the fundamental problems; for until these are settled no satisfactory progress can be made.

COAL TRANSPORT SCHEME.

In an editorial article on "Coal Transport Considerations," the "Iron and Coal Trades Review" remarks: "Much interest and curiosity have been aroused by the Controller's statement that his scheme is estimated to save 700 million ton-miles annually. We have already pointed out that 700 million ton-miles at ½d. per ton-mile mean 1½ millions sterling. . . . It may be observed that such an economy would mean setting free in one year railway transport capable of carrying 7,000,000 tons 100 miles. This quantity, of course, is less than half the requirements of London alone, and represents about 20,000 10-ton wagons on the basis of three journeys a month. On the same basis, it may be estimated that the 600,000 or more private wagons on British railways, most of which are engaged in mineral traffic, alone run some 21,600,000,000 ton-miles annually, and they actually run a great deal more, of course, as their journeys are not limited to 100 miles, and they sometimes do more than three journeys a month. But enough has been said perhaps to indicate that 700 million ton-miles, even if they can be saved, form but a small percentage of the total ton mileage of the country. . . . It is important that all consumers should be supplied with suitable coal as far as possible. Any other policy defeats its own object, inasmuch as with the poorer sorts a larger quantity is necessary to achieve the same result." Even though 700 million ton-miles represent but a small percentage of the total ton mileage of the country, in these times such a saving cannot be belittled. Every saving means something worth having in the whole economy. Supplement it by the saving that could be effected by reducing the inert material or dross carried now (and sold as good coal) through bad picking at the mines; and the result is considerably strengthened.

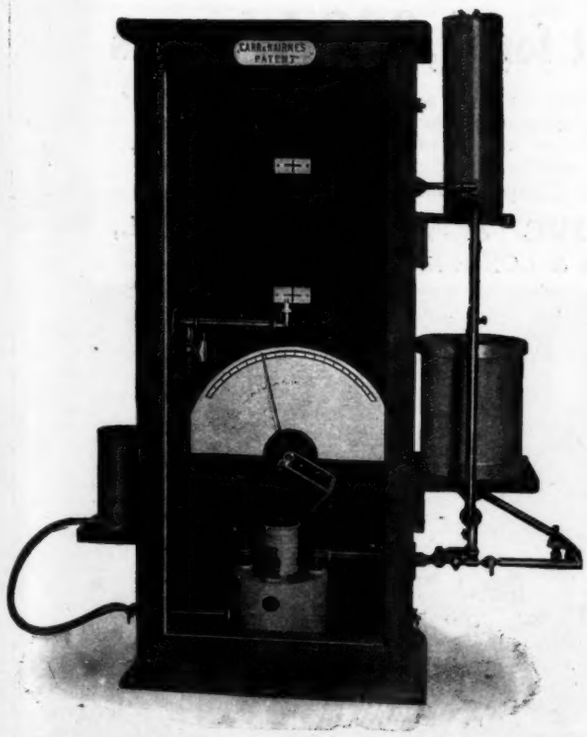
VEHICLES PROPELLED BY GAS.

The Manager of the Scottish Motor Traction Company, after a number of experiments, has succeeded in making use of coal gas as a substitute for petrol. The holder containing the gas is formed of specially prepared rubber, and takes a sufficient supply to propel the bus for a distance of fifteen miles. The Company's vehicles are now a feature of Edinburgh: They connect the city with outlying towns and villages, most of which are within the fifteen-mile limit. It is expected that the new arrangement will enable the Company to maintain their full time-table, and, by reducing running costs, render unnecessary any increase on pre-war fares.

The Southend Corporation Gas Committee have given consideration to an application from the local Char-a-Banc Company for permission to erect a meter-house in one of the shrubberies of the Marine Parade in connection with a proposal to adopt the use of coal gas for the running of motor chars-a-bancs. The Committee had visited the site, and interviewed the Directors of the Company and the Manager of the Southend Gas Company, and decided to recommend the Council to grant the permission asked for.

The transfer of the offices of the Department of Scientific and Industrial Research (including the Fuel Research Board) to No. 15, Great George Street, Westminster, S.W. 1, takes place to-day.

JET CALORIMETER.



CARR & NAIRNE'S PATENT.

SPECIALLY designed by the Inventors for use on crude gas, to show, **within a few minutes of its generation,** the calorific power of the gas made in the retort house or other plant. It is placed as near as practically possible to the retort house, and therefore enables any irregularity to be corrected instantaneously, and gas of an even quality to be manufactured day and night.

The desideratum of all Gas Engineers —that of supplying an evenly constituted gas to the consumers—can be accomplished, many complaints attributable to varying quality of gas avoided, **and a greatly increased make of gas per ton of coal carbonized is secured.**

ALEXANDER WRIGHT & CO., LD.

WESTMINSTER.

AGENTS:

Australia—FYVIE & STEWART, 360, Collins Street, Melbourne.
Canada—W. P. ROPER, Merchants' Bank, Building, Montreal.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *July* 23.

It is reported that 42s. 6d. net per ton f.o.b. export ship at maker's works has been paid for pitch. The position of this product is strong; and manufacturers seem disposed to await the development of the situation. Creosote and the other products under official control are without alteration in price.

Sulphate of ammonia is still governed by the official prices in the interest of home agriculture; while the export is controlled mainly through an official Committee.

Tar Products in the Provinces.

July 23.

There is nothing fresh to report concerning the market for tar products.

The average values for gas-works products during the week were: Gas-works coal tar, 20s. to 24s. 6d. Pitch, East Coast, 16s. 6d. to 17s. 6d. per ton; West Coast—Manchester 15s. 6d. to 16s. 6d., Liverpool 16s. 6d. to 17s. 6d., Clyde 17s. to 18s. nominal. Benzol, 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3¼d. to 3⅜d. Heavy oils, in bulk, North, 3⅜d. to 4½d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

Manchester District Tar Prices.

The average price realized for tar in this district, based on the value of the products for the month of June, was 27s. 4d. per ton.

COAL TRADE REPORT.

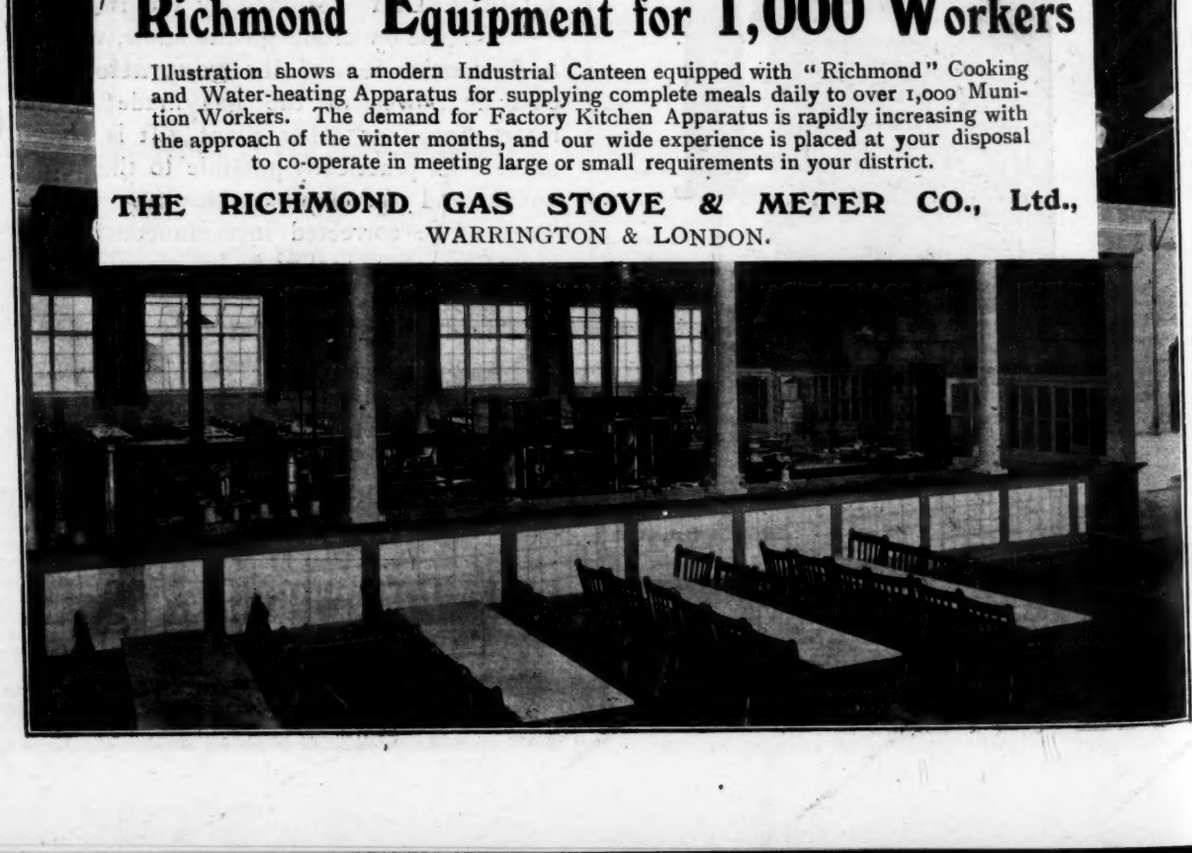
Northern Coal Trade.

There is a good demand for the best classes of coal, but exports are rather limited. In the steam coal trade the demand is fair. The price of best Northumbrian steams is about 30s. per ton f.o.b.; second-class descriptions are in fair inquiry at from 25s. 6d.; steam smalls are 18s. 6d. to 20s. 6d. Work is well maintained at the collieries; but the scarcity of steamers occasionally makes a pit idle a day or so. In the gas coal trade the demand seems to be increasing. "Wear Specials" are firm at from 28s. to 30s. per ton f.o.b.; best Durhams are steady at 25s.; and second-class gas coals are about 23s. 6d. per ton. There is not much doing in the new contracts; but this inactivity is not surprising when the Controller's stipulation is borne in mind, that they do not "come into operation" till Sept. 10. Other buyers may wait a little, though there is the possibility of freights in the autumn being higher. Gas coal from the Tyne to London is quoted about 15s. freight; but the rates vary with the scarcity or otherwise of steamers for that branch of the trade. Good gas coke is from 30s. 6d. to 32s. per ton f.o.b., according to the place of shipment. Freights on coke are based on about 45s. from the Tyne to the Northern ports of France.

Rothwell Gas Supply.—The annual report and balance-sheet of the Rothwell gas undertaking for the year ended March 31 has been issued. It shows that the gross profit was £704; and the sum of £950 is required for loan repayment and interest. There is a net loss of £246 on the year's working.

Market Harborough Gas Undertaking.—The Market Harborough gas undertaking has had a fairly successful year. The accounts just published show that the total receipts amounted to £12,080, while the expenditure came to £10,339. The amount of the loan originally borrowed was £54,000. On this, the sum of £977 had been paid as interest during the year. The amount paid as principal was £1254; and the balance owing at March 31 was £45,180.

Oldham Gas Department Administration.—In a letter appearing in the "Oldham Chronicle" attention is drawn to the resignation of Mr. Arthur Andrew, owing to ill-health, from the position of General Manager of the Gas and Water Departments of the Corporation, whose service he entered as office boy on June 4, 1866—thus having completed 51 years with the departments. It is, says the writer, a matter of great pain to him to think that a gentleman who has done so much for Oldham as Mr. Andrew has should be treated with such scant consideration; and he urges that Mr. Andrew's long record of underpaid service should have induced the Town Council at least to appoint him Consultant, though an unconditional retiring allowance would be no more than his due. The writer continues: "In view of the re-arrangements of staff caused by his retirement, I know that any such allowance would be repaid ten times over by the shrewd advice and sound experience which would thus be available. I would mention that pensions, retiring allowances, or appointments as consultants for officials and workmen of long service are customary with companies—why not with corporations? Corporation service is quite as arduous, and is generally worse paid, than in the case of companies. . . . . I would ask each member of the Town Council to reconsider Mr. Andrew's case, not with a view to generosity, but with a view to the justice for which I plead. Anything less would be unworthy of the town and of its municipal representatives."


"Richmond" Equipment for 1,000 Workers
Illustration shows a modern Industrial Canteen equipped with "Richmond" Cooking and Water-heating Apparatus for supplying complete meals daily to over 1,000 Munition Workers. The demand for Factory Kitchen Apparatus is rapidly increasing with the approach of the winter months, and our wide experience is placed at your disposal to co-operate in meeting large or small requirements in your district.
THE RICHMOND GAS STOVE & METER CO., Ltd.,
WARRINGTON & LONDON.

Sulphate of Ammonia Exports.—The June exports of sulphate of ammonia are returned at 1645 tons, the f.o.b. value being £33,951, equivalent to, approximately, £20 12s. 6d. per ton. For the completed half year the shipments aggregate 36,511 tons, compared with 127,880 tons in 1916, and 159,976 tons in 1915.

Wages at Brighouse.—The Brighouse Corporation General Purposes Committee, after considering an application by the Workers' Union for an increase of wages equal to 12s. per week over pre-war rates, recommend the Council to adopt a principle of 10s. advance over pre-war rates to the employees, with exceptions such as the respective committees may deem advisable; that such advances be retrospective to July 1; and that, failing acceptance of these terms, the matter be referred to arbitration.

Stirling Gas Light Company.—A statement of the position of the Stirling Gas Light Company shows that the balance at the credit of profit and loss, after payment of interest, income-tax, and dividend on the preference shares, is £5153. A dividend is paid, on each share of £5 7s. 6d., of 87·194d.; and on the new £10 shares, at the rate of 10s. per share. A sum of £1640 is carried forward. For the year ended May 15, the gas manufactured was 130,246,552 c.ft., yielding £22,050. The revenue account shows for residuals, £6525; rental of meters, £740; and rent of stoves, £322. Notwithstanding the increase of wages and materials, the Company had written-off £2000 from the account of value of superseded gasholders.

Quality of Gas at Keighley.—A statement was made at the monthly meeting of the Keighley Town Council that complaints were general as to the bad heating and lighting quality of the gas supplied. It was pointed out in reply that the treatment of the gas to meet war conditions made some slight difference in heating and candle power; and the need for the proper adjustment of burners was emphasized. So far as heating was concerned, the depreciation was said to amount to no more than 6 p.ct. In regard to lighting, it meant a reduction of about 2 c.p. in the case of flat-flame burners; but with incandescent burners, the illuminating power was hardly affected at all.

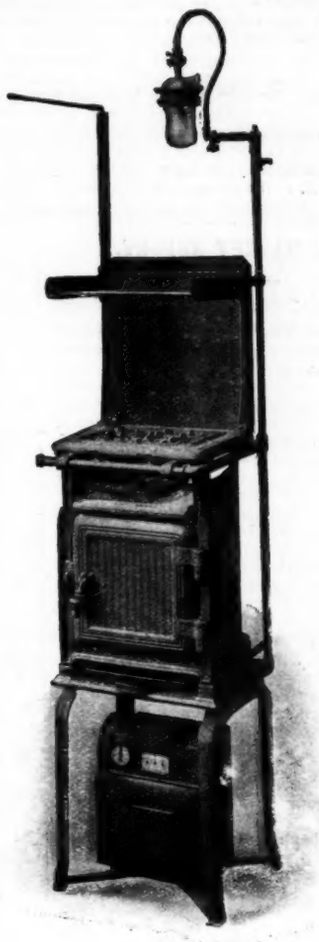
Coal Transport Re-Organization Scheme.—In connection with this scheme, the Controller of Coal Mines is considering the requirements of steam-raisers in regard to supplies of special coal fuel. Forms have been sent out to steam-raisers throughout the country, asking for information in regard to the class of coal used, consumption, &c. A considerable number of the forms sent out have not been returned; and steam-raisers who have received such forms are asked to note that their requirements in the way of special fuels cannot be considered in the absence of the information called for by the forms, which should be filled in immediately and dispatched to the Controller of Coal Mines. In cases where steam-raisers have not received forms, they should apply at once to the Controller of Coal Mines, at No. 8, Richmond Terrace, Whitehall, London, S.W. 1.

Oswaldtwistle Gas Engineer Complimented.—Mr. T. C. Usher (the Chairman of the Gas Committee), at last Thursday's meeting of the Oswaldtwistle Town Council, presented a report dealing with the working of the gas department for the last financial year. He said the cost of coal carbonized amounted to £6379, an increase over the previous year of £880. The total revenue from gas was £10,334, and from residuals £4569—making, with miscellaneous revenue, a gross income of £15,578. The expenditure amounted to £11,931, leaving a gross profit of £3646, as against £2662, which, after payment of interest on loans and sinking fund charges, left a net profit of £1004, as compared with £161 the previous year. The report was unanimously approved. Mr. A. Hargreaves, J.P., observed that great credit was due to their Engineer (Mr. J. H. Davies), whose work in the gas undertaking since his appointment ten years ago had been performed with credit to himself and to the best possible advantage of the ratepayers.

Aldershot Gas, &c., Company.—The accounts of the Aldershot Gas, Water, and District Lighting Company for the half year ended June 30 show a surplus of £10,882; and the Directors recommend the payment of full statutory dividends. In spite of the Summer Time Act, the increase in the sales of gas (exclusive of works and special contract) was nearly 10¼ p.ct. The electricity department also continues to extend; the increase in sales for the half year being nearly 153⅓ p.ct. The Directors record, with great regret, the death of Mr. A. F. Wilson, on April 12. Mr. Wilson had been long associated with the Company—in its early days as Lessee, and since 1881 as Director. For 28 years, to 1910, he presided as Chairman. Then, owing to advancing age, he decided to stand aside, but continued as Director until his death. It has been unanimously decided to invite Mr. R. W. Edwards (the General Manager) to fill the vacancy created by the death of Mr. Wilson; and, at Mr. Edwards's request, the election has been deferred till an appropriate date, subsequent to the meeting, when he will be offered the position of Managing-Director. Mr. Edwards has been with the Company, as Chief Officer, for nearly nineteen years; and it is felt his valuable work is well known to the stockholders.

Gas Progress in Connecticut.—Some American State Commission reports for 1916, recently issued, indicate robust progress. The annual record of the Connecticut Public Utilities Commission sets forth that during the year the total investment in gas securities advanced from about $14,750,000 to $15,750,000. The receipts for sale of gas went up 10 p.ct., those for residuals 25 p.ct., and other miscellaneous sources of income, which probably include sales of appliances, no less than 200 p.ct. Against this, there is an increase in manufacturing expenses of 12 p.ct., for public street lighting 100 p.ct., taxes 20 p.ct., and depreciation 33 p.ct.; but the net revenue has advanced nearly 10 p.ct. The gross income was $4,138,531—an increase of 14 p.ct.; but as it does not greatly exceed one-fourth of the capital investment, the undertakings are rather heavily capitalized. In addition, fifteen companies supply both gas and electricity—coal, water, and mixed gas being used, with one exception in favour of acetylene. The investment on gas is kept separate, and amounts to about $5,000,000; and the total income on the gas section was $1,082,686. The expenditure was $827,399, leaving a net revenue of $255,287. While the income has increased 23 p.ct., there is only a small addition to the net profit, due to expanded manufacturing expenses, more gas purchased in bulk, and largely advanced taxes and depreciation.

Slot Installations



Our compact Combination Set is solving the fitting-up problem.

A Slot Meter.
A Cooker at working height.
A Plate Rack with enamelled back plate.
A Towel Rail
and
An Inverted Burner together with T-piece connection for extensions.

Saves labour, material, and space.

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, PRINCES STREET, OXFORD CIRCUS, W.; 82, Gordon Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Gas-Works Sold at Auction.—Last Thursday, Mr. A. W. Cock offered for sale by auction, as a going concern, the works and rights of the Appledore Gas Company, Ltd., North Devon. The Company supply the Appledore district with gas; and included in the property were 200 meters, 70 public lamps, and the working plant of the concern, which was established in 1874. Bidding started at £800; and the property was purchased by Mr. R. H. Groves (the Chairman of the Blandford Gas Company) for £1350.

Gratification at Selby.—It was unanimously agreed at a meeting of the Selby Urban District Council that the Clerk be instructed to write a letter to Mr. T. H. Alderson (the Gas Engineer and Manager) expressing the gratification of the Council at the satisfactory report on the past year's operations at the gas-works. The report showed that the output of gas in the twelve months ended March 31 was practically the same as in the preceding year; the make per ton of coal carbonized being 11,537 c.ft., as compared with 11,523 c.ft. for the year before. The unaccounted-for gas amounted to 5·4 p.ct. The result of the operations is a gross profit of £1972, and a net profit of £1234; the £738 paid for instalments and interest on loans and placed to sinking funds being equal to 3·81d. per 1000 c.ft. of gas sold. There was an increase in the amount received for gas of £171, due to an addition of 4d. per 1000 c.ft. to the price, which came into force on Oct. 1, 1915.

Newport (Mon.) Gas Company.—In the report which will be submitted to the proprietors next week, the Directors recommend payment of the statutory dividend. They regret having received the resignation of the Deputy-Chairman (Mr. T. G. Cartwright) owing to his removal from the district, and place on record their high appreciation of his 24 years' devoted service. Mr. George Geen has been appointed Deputy-Chairman; and Sir A. Garrod Thomas, M.P., has been elected to fill the vacancy on the Board.

Gas-Workers' Wages at Dundee.—The Dundee Gas Committee have decided to refer to arbitration the question of whether or not the labourers in the Gas Department should participate in the recent award made to other sections of the engineering industry. Mr. Alex. Yuill (the Gas Manager) stated that at the last meeting of the Committee it was practically arranged that the labourers at the gas-works should be brought into line in respect of wages with those in the Works Department. It was agreed to give them an increase which brought up their wages to 10s. 7d. over the pre-war wages; and the application they now made was that they should get 12s. advance over the pre-war rate. It was agreed that the advance voted by the Town Council a month ago should be paid as from then; and that the further advance of 1s. 5d. should be made retrospective, if sanctioned by the Arbitrator.

STOCK MARKET REPORT.

Business on the Stock Exchange seems almost to have settled down into a groove—week after week—in succession exhibiting a monotonous sameness. Having regard to the general firmness of most of the leading departments, this is not an unwelcome feature; but it does not contribute to the formation of interesting history. The most desirable factor—*i.e.*, an increase in the volume of business—seems still to be far off as ever, and the unconquerable inactivity detracts from the measure of cheerfulness which markets enjoy, and have for some time past been enjoying. Last week, indeed, the tone daily became brighter and brighter until Friday, when the intelligence of a recrudescence of unrest in Russia. This precipitated a reaction which is not unusual after a too liberal rise in prices.

The gilt-edged market, however, came out well on balance, notwithstanding the check. Home Government issues were in good demand. War Loan and Consols showed great strength, and Indian and Colonial issues were firm. Home rails did fairly well, especially prior charges. The American Market came in for little attention, and drooped from inanition; but Argentines were in good demand, founded on hopeful expectation of better rates.

The Foreign Market was less prominent than the week before. Of course, everything Russian had a set-back; but there was no weakness elsewhere, save when there was a little profit-snatching after the Brazilian advances. French loan improved, and Chinese was stimulated by Republican successes. There was some inquiry for Greek. South Africans were dullish. Among the rest, Rubber was firm; but Oils were rather irregular. Iron and Steel concerns were among the popular ones.

Business in the Gas Market quite failed to maintain the burst of activity which it displayed the preceding week, and fell back into its former provoking state of listlessness. Only some half-a-score of undertakings were touched at all, and most of these were only nibbled at. Prices of bargains marked showed hardly any change from the week before, and there was only one variation in quotation, which was for the better. The Gas Light and Coke Company Board recommend the payment of the full statutory rates of dividend. The Money Market was easier, but discount rates ruled firm.

Bargains done for cash during the week were as follows: On Monday, British 33¼, ditto debentures 66, 66⅜, Gas Light ordinary 71⅜, 72, 72¼, ditto preference 73½, Imperial Continental 79½, 80, Primitiva 38s., 39s. 3d., ditto preference 56s. 6d., South Metropolitan 74, 74½, Tottenham "A" 90. On Tuesday, Brentford "B" 78, British, 33, 33½, Commercial debenture 52, European 12, Gas Light ordinary 71¾, Imperial Continental 79½, 80, ditto debenture 63, Sheffield "B" 180, South Metropolitan 74, 74½. On Wednesday, British 33, Continental Union 39½, ditto preference 60¾, Commercial debenture 52½, European 12 5/16, 12¼, Gas Light ordinary 71½, 71⅜, 72½, South Metropolitan 74½. On Thursday, Continental Union 39½, 40, Imperial Continental 79½, 80, 80¼, South Metropolitan 75. On Friday, European 12½, 12⅜, Gas Light Ordinary, 71½, 71⅜, 72½, 72¼, Primitiva preference, 57s. 6d., South Metropolitan 75.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex. Dividend.	Previous Div or Dividend and Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	58—63	..
1,551,868	,,	April 8	2½	5⅛%	Alliance & Dublin Ord.	59—64	50—55	..
374,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	57—62*	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	57—62	43—54	..
50,000	10	Feb. 26	16	15/-	Bourne-mouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	29—30	24—26	..
383,110	10	,,	7	7/-		15—15½	10⅞—11½	..
115,000	10	,,	6	6/-		13½—14	9½—92	..
159,740	—	—	—	4%		..	69—71	..
992,045	Stk.	Feb. 26	14	5½%	Brentford A Consolid.	261—266	79—83*	..
734,920	,,	,,	11	4⅛%	Do. B New	204—209	77—80*	78
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	81—86*	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	65—67	..
217,380	,,	Feb. 26	11	10⅝%	Brighton & Hove Orig.	208—213	150—155	..
244,300	,,	,,	8	7⅝%	Do. A Ord. Stk.	154—159	102—107	..
530,000	20	Mar. 26	12½	22/6	British	44—45	33—34	33—33½
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68	66—66½
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—56	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½—2½	2½—3	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79½—80½	..
1,513,280	,,	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	72—74	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	66—68	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	51—53	53—52½
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	39—41	39½—40
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	60—62	60½
278,400	,,	—	—	11½%	Croydon B and C 7 p.c..	..	170—180	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5⅛%	Derby Con. Stk.	123—125	95—100	..
55,000	,,	—	* 4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	7/6	European, Ltd.	17½—18	11½—12½	12—12½
16,313,430	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb. 10 p.c. Bonds	98—102	71—73	71½—72½
2,600,000	,,	,,	3½	3½%		76—79	56—58	..
4,062,235	,,	,,	4	4%		96—99	72—74	73½
4,674,850	,,	June 11	3	3%		72½—74½	55—57	..
130,000	,,	,,	10	10%		..	..	..
258,740	,,	Mar. 12	5	4½%	Hastings & St. L. 3½ p.c.	87—89	50—55	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16½	7½—8½	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	120—130	..
131,000	Stk.	Mar. 12	7⅞	7⅞%	Ilford A and C.	151—154	95—100	..
65,780	,,	,,	6⅜	5⅞%	Do. B	115—118	75—80	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb	92—94	65—68	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	79—84	79½—80½
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	62—65	63
235,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	85—90	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A B	211—213 146—148	82—83	..
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	72—74	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	3⅞—4⅛	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	88—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11⅛—12	8—8½	..
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	70½—71	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	71—73	..
55,940	10	Feb. 26	7/14/0	7/-	North Middlesex 7 p.c.	14—15	10—11	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅛—7⅜	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	92—97	..
100,000	50	,,	12	11%	Do. C	118—121	85—90	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	1⅞—2⅛	33/0—39/3
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅝—5	2⅜—3⅛	56/6—57/6
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	78—80	..
—	—	—	—	4%	Do. ,, ,, 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	59—64	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref. 5 p.c. Deb.	10½—11	7⅜—8⅛	..
125,000	50	July 1	5	5%		47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—234	..	..
209,984	,,	,,	10	10%	Do. B	223—234	178—182	180
523,500	,,	,,	10	10%	Do. C	220—222	..	..
90,000	10	May 28	9	6/-	South African.	10½—11½	8¾—9½	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	73—75	74—75
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	55—57*	..
224,820	,,	Feb. 26	8½	8%	South Shields Con. Stk.	157—159	140—142	..
952,795	,,	,,	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	76—78	..
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	77—79	..
135,000	—	—	—	48/4	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	86—88	..
647,740	,,	May 14	5	5%	Southampton Ord.	99—102	76—78	..
120,000	,,	Feb. 12	7⅛	5%	Tottenham District { A 5 p.c. B 3½ p.c. 4 p.c. Deb.	135—138	95—100	90
782,275	,,	,,	6	3⅛%		115—117	68—73	..
181,255	,,	June 26	4	4%		87—89	63—65	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	89—91	..
30,000	,,	Feb. 26	8⅜	80/-	Wandsworth, Wimbledon, and Epsom—			
255,636	,,	,,	6⅝	65/-	Wandsworth A 5 p.c..	151—156	114—119	..
108,075	,,	,,	5/17/3	56/-	Do. B 3½ p.c.	122—124	99—101	..
352,000	,,	,,	6⅛	58/9	Do. C 3½ p.c.	110—115	86—91	..
98,000	,,	,,	6⅜	65/-	Wimbledon 5 p.c.	117—122	88—98	..
88,416	,,	June 26	3	3%	Epsom 5 p.c.	121—126	96—101	..
					3 p.c. Deb. Stk.	66—69	50—53	..

* Ex. Div.

The price of gas at North Berwick has been increased from 5s. to 5s. 7½d. per 1000 c.ft.

The Jedburgh Gas Company have paid a dividend of 6s. per £6 share, free of income-tax. A sum of £50 is placed to depreciation account; and a balance of £112 is carried forward.

The Selkirk Gas Company are paying a dividend of 5 p.ct., and placing to depreciation account £450. The present price of gas—3s. 11½d. per 1000 c.ft.—is maintained. For the year to April 30, the total make of gas was 34,081,500 c.ft.—a decrease of 7,993,900 c.ft. as compared with the previous year.

Charlotte Thompson, of Golcar, who lived alone, committed suicide by fastening a piece of rubber piping to a bracket and inhaling gas. The window and chimney of the room in which she was found were blocked-up. It was stated at the inquest that deceased had suffered from illness and great depression.

A verdict of "Accidental death" was returned at Bexhill, in the case of a woman, 67 years of age, who was found dead in her bath. There was a geyser in the room, the tap of which was turned fully on, but the gas was not lighted. The doctor said he thought deceased had first been overcome by the gas, and then drowned. The windows were tightly shut; and there were practically no means of getting fresh air into the room.

The current issue of the "Croydon Co-Partner" contains as a supplement the rules of the Croydon Gas Company's co-partners' pension fund, which came into operation on April 1 last. Members joining up to the age of thirty contribute a sum equal to 3 p.ct. of their salary or wages for the time being; those upwards of thirty years, 4 p.ct. Special provision is made for co-partners who were at the starting of the fund over fifty years of age. No pension is to be paid for a period of ten years from the commencement of the fund.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Stratford-on-Avon Corporation. Applications by July 31.

ENGINEER AND MANAGER. Seaford Gas Company. Applications by Aug. 8.

GAS MANAGER. Scunthorpe Urban District Council. Applications by Aug. 9.

MANAGER. No. 6328.

ASSISTANT ENGINEER AND MANAGER. No. 6329. Applications by July 30.

Appointments, &c., Continued.

ASSISTANT MANAGER. Peterborough Gas Company.

WORKING MANAGER. Eye Gas-Works.

WORKING FOREMAN. Stoke-on-Trent Gas-Works.

GAS FITTER. Frome Gas-Works.

STOKER. Yorktown Gas-Works.

Appointments, &c., Continued.

SKILLED LABOURER. Chiltern Hills Spring Water Company.

Meeting.

TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY. No. 639, High Road, Tottenham, Aug. 18. Three o'clock.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, May 15, p. 268.

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GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

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BAGLEY, MILLS, & Co., Ltd.,
92, Victoria Street, Westminster, S.W., invite inquiries from all gas-works making 75 million cubic feet and upwards per annum.
See illustrated Advertisement Feb. 20, p. III. of Centre.

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WANTED—A Manager for 6 Million Works. Good Wages to Capable Man.

Apply, giving full Particulars as to Qualifications, Age, if Married, number in Family, &c., to No. 6328, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

WANTED—A Gas-Fitter Experienced in Fixing and Maintenance of Cookers, Gas Fires, and Incandescent Burners; also able to Lay Mains and Services if required.

Apply, with References, Stating Age and Wages required, to the MANAGER, Gas-Works, FROME.

STOKER Wanted—Used to Shovel Charging. Wages, 7s. per Twelve-Hour Shift. Holiday, with pay. 9s. paid for Sunday Shifts. Permanency for suitable man.

Apply to MANAGER, Gas-Works, Yorktown, SURREY.

WANTED, immediately, a WORKING MANAGER for a Small Country Works (about 3 Millions). Exhauster. Knowledge of Fitting. Cottage, Coal, and Gas.

Apply to the SECRETARY, Gas Company, Eye, SUFFOLK.

ASSISTANT Engineer and Manager Wanted for Gas-Works. Annual make over 1000 Millions.

Applications, stating Age, Experience, Qualifications, and Salary expected, enclosing *copies* of Three recent Testimonials, to be made in the first instance to No. 6329, care of MR. KING, 11, Bolt Court, FLEET STREET, E.C. 4, not later than the morning of Monday, the 30th inst.

PETERBOROUGH GAS COMPANY.

ASSISTANT MANAGER Wanted— Must be thoroughly Experienced in Retort House Work and Electrical Plant.

Apply, giving Age, Experience, and References, to
JOHN BARTON,
Manager and Secretary.
Gas-Works, Peterborough,
July 18, 1917.

SCUNTHORPE URBAN DISTRICT COUNCIL.

APPOINTMENT OF GAS MANAGER.

THE above Council invite Applications for the Position of WORKING GAS MANAGER.

Salary, £900 per Annum, with House, Rates, Water, and an agreed quantity of Coals and Gas free.

Applications, in candidates' own handwriting, with *copies* of Two recent Testimonials, to be sent to the undersigned not later than Thursday, the 9th of August, 1917, marked "Gas Manager."

By order,
G. E. DAVY,
Clerk to the Council.
110, High Street,
Scunthorpe, Lincolnshire.

STRATFORD-UPON-AVON CORPORATION.

(GAS DEPARTMENT.)

APPOINTMENT OF ENGINEER AND MANAGER.

THE Council invite Applications for the Position of ENGINEER and MANAGER of the Gas-Works. Candidates must be thoroughly Experienced in Modern Carbonizing Methods, Sulphate of Ammonia and Dehydrating Tar Plants, and Capable of Designing and Carrying Out Extensions of Works and Mains when necessary.

Salary, £250 per Annum, with Residence, Coal, and Gas provided at the Gas-Works.

Application, in writing, stating Age, Qualifications, whether Married or Single, together with *copies* of Three recent Testimonials, must be addressed to me not later than July 31, 1917.

Canvassing in any form will disqualify the Applicant.

ROBERT LUNN,
Town Clerk.
July 10, 1917.

CHILTERN HILLS SPRING WATER COMPANY, AYLESBURY.

WANTED—Skilled Labourer for Repairing Mains in Tring District, and to assist in Repairs to Deep Well Pumps, Cleaning out Boilers and Reservoirs; also Work General to Pumping Station. Wages, £1 7s. 6d. per Week. House, Garden, and Coal provided at Dancer's End Station.

Applicants must state Age and Qualifications.

H. A. CALLON,
Manager.

WANTED, by the Borough of Stoke-on-Trent, a WORKING FOREMAN for their Stoke Works. Must be a Good Carbonizer and have General Experience of Gas-Works Plant. Wages, 55s. per Week.

Apply, stating Age and Experience, with recent Testimonials, to the undersigned.

A. MACKAY,
Chief Engineer and General Manager.
Gas-Works, Longton,
Stoke-on-Trent.

SEAFORD GAS COMPANY.

THE Directors invite Applications for the Position of ENGINEER and MANAGER. Salary, £250 per Annum.

Candidates must be thoroughly experienced in Carbonization, Making Carburetted Water Gas, Sulphate of Ammonia, Dehydrating Tar, and Designing and Carrying Out Extensions to Works.

Applications, stating Age, Experience, and enclosing *copies* of Three recent Testimonials, to be addressed to the CHAIRMAN, at the Gas-Works, SEAFORD, Sussex, on or before Aug. 8.

GASHOLDERS and Other Plant Wanted, either for Re-use or Scrapping. Dismantling Specialists.

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TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, No. 639, High Road, Tottenham, on Saturday, the 18th day of August next, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ending the 30th of June, 1917; to declare Dividends; to elect two Directors and an Auditor for the ensuing year; and to transact General Business.

The TRANSFER BOOKS for the Consolidated "A" and "B" Stocks and the Preference Stock WILL BE CLOSED from Saturday, Aug. 4, to Saturday, Aug. 18, both days inclusive.

By order of the Board,
E. J. K. FUSSELL,
Secretary.
Chief Offices of the Company,
639, High Road, Tottenham,
July 19, 1917.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at THE MART, TOKENHOUSE YARD, E.C.

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